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(54) MOUNTING METHOD FOR IN-WHEEL MOTOR AND IN-WHEEL MOTOR SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a mounting method for an in-wheel motor and an in-wheel motor system capable of reducing fluctuation in tire road holding force of a vehicle and improving road holding property of the vehicle.
SOLUTION: A non-rotation side case 3a to which a motor stator 3S of the in-wheel motor 3 is fixed is connected with a knuckle 5 which is a chassis component of the vehicle through a first elastic member 11. A rotation side case 3b to which a motor rotor 3R is fixed and which is rotatably connected with the non-rotation side case 3a through a bearing 3j is connected with a wheel 2 rotating through a second elastic member 13 to mount the in-wheel motor 3 by floating for each component in a chassis part.
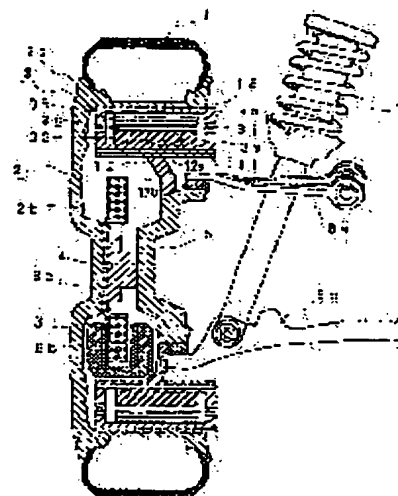
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CLAIMS

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[Claim(s)]
[Claim 1]
Means of attachment of the in wheel motor characterized by attaching the above-mentioned motor in
the vehicle spring lower part through a buffer member or a shock absorber in case an in wheel motor
is attached in a direct-drive wheel.
[Claim 2]
Means of attachment of the in wheel motor according to claim 1 characterized by having combined
the nonrotation side case and knuckle of the above-mentioned motor through the 1st elastic body,
and combining a revolution side case and a wheel through the 2nd elastic body.
[Claim 3]
Means of attachment of the in wheel motor according to claim 1 characterized by having combined
the nonrotation side case which supports the stator of the above-mentioned motor, and the knuckle
which are the axle part components of a vehicle according to the direct-acting guide device, and
combining with the radial direction of a wheel the revolution side case which supports Rota of the
above-mentioned motor, and the wheel of each other according to the driving force transfer device in
which eccentricity is possible.
[Claim 4]
Means of attachment of the in wheel motor according to claim 1 characterized by having combined
the nonrotation side case and knuckle of the above-mentioned motor through the direct-acting guide
device containing a damper, and combining a revolution side case and a wheel through the 2nd
elastic body.
[Claim 5]
Means of attachment of the in wheel motor characterized by attaching the nonrotation side case of
the above-mentioned motor in a car-body side through a shock absorber in case an in wheel motor is
attached in a direct-drive wheel.
[Claim 6]
Means of attachment of the in wheel motor according to claim 1 to 5 characterized by attaching the
above-mentioned motor so that the resonance frequency of the motor section attached the account of
a top may be high and may turn into a frequency lower than the resonance frequency of the spring
lower part from the resonance frequency of the vehicle spring upper part.
[Claim 7]
The in wheel motor system characterized by attaching the above-mentioned motor in either a vehicle
spring lower part side and a car-body side and both through a buffer member or a shock absorber,
and changing in the in wheel motor system which equips the wheel section with the electric motor of
a hollow configuration, and drives a wheel by the above-mentioned motor.
[Claim 8]
The in wheel motor system according to claim 7 characterized by combining a motor and the wheel
of each other with a constant-velocity joint or the radial direction of a wheel according to the driving
force transfer device in which eccentricity is possible.
[Claim 9]
The in wheel motor system according to claim 8 characterized by constituting according to the
coupling device equipped with the direct-acting guide which shows the above-mentioned plate of

each other which carries out contiguity to the radial direction of a disc while combining between the above-mentioned plates which adjoin two or more plates of hollow discoid in the above-mentioned driving force transfer device.

[Claim 10]
The in wheel motor system according to claim 7 to 9 characterized by combining the nonrotation side case which supports the stator of the above-mentioned motor, and the knuckle which are the axle part components of a vehicle according to a direct-acting guide device.

[Claim 11]
The in wheel motor system according to claim 7 to 10 characterized by forming a buffer member or a shock absorber in at least one side or both between the nonrotation side case of the above-mentioned motor, and a knuckle, and between a revolution side case and a wheel.

[Claim 12]
The in wheel motor system according to claim 7 characterized by combining the revolution side case which supports Rota, and a wheel through the 2nd elastic body while combining the nonrotation side case which supports the stator of the above-mentioned motor, and the knuckle which are the axle part components of a vehicle through the 1st elastic body.

[Claim 13]
The in wheel motor system according to claim 12 characterized by constituting both the 1st and 2nd both [ at least one side or ] of the above by the pneumatic spring.

[Claim 14]
The in wheel motor system according to claim 12 characterized by having combined the end of this cylinder with the wheel and combining the other end with a revolution side case while making the 2nd elastic body of the above cylindrical.

[Claim 15]
The in wheel motor system according to claim 12 characterized by combining a wheel and a revolution side case with 16 or less abbreviation tabular elastic bodies arranged at equal intervals in parallel with a wheel tangential direction.

[Claim 16]
The in wheel motor system according to claim 15 characterized by preparing the revolution splice hand-loom style centering on the tangential direction of a motor in the ends side of the cross direction of the above-mentioned tabular elastic body.

[Claim 17]
The in wheel motor system according to claim 12 characterized by combining the rib extended in the direction of the wheel section from a revolution side case, and the rib extended in the direction of a revolution side case from a wheel with an elastic body in two or more places.

[Claim 18]
The in wheel motor system according to claim 12 to 17 characterized by setting to 1MPa-120MPa the modulus of direct elasticity of the ingredient which constitutes the 1st and 2nd elastic bodies of the above.

[Claim 19]
The in wheel motor system according to claim 12 to 17 characterized by setting to 10GPa-300GPa the modulus of direct elasticity of the ingredient which constitutes the 1st and 2nd elastic bodies of the above.

[Claim 20]
The in wheel motor system according to claim 12 to 19 characterized by making the elastic modulus of the vertical direction lower than the elastic modulus of a cross direction to the vehicle of the 1st elastic body of the above.

[Claim 21]
The in wheel motor system according to claim 12 to 20 characterized by having replaced with the 1st elastic body of the above, and combining the above-mentioned nonrotation side case with a knuckle through the direct-acting guide device equipped with the spring and the damper.

[Claim 22]
The in wheel motor system according to claim 12 to 21 characterized by combining the above-mentioned revolution side case with a wheel through a constant-velocity joint.

[Claim 23]

An in wheel motor system given in above-mentioned claim 22 characterized by attaching the 2nd elastic body in the center-of-mass location of the above-mentioned motor in the motor cross direction.

[Claim 24]
The in wheel motor system according to claim 12 to 21 characterized by making it combine with a wheel through the coupling device equipped with the direct-acting guide which shows the above-mentioned plate of each other which carries out contiguity to the radial direction of a disc while combining between the above-mentioned plates which adjoin two or more plates of hollow discoid in the above-mentioned revolution side case.

[Claim 25]
While combining the nonrotation side case which supports the stator of the above-mentioned motor with the knuckle which are the axle part components of a vehicle through a buffer member or a shock absorber While combining between the above-mentioned plates which adjoin two or more plates of hollow discoid in the revolution side case of a motor The in wheel motor system according to claim 7 characterized by making it combine with a wheel through the coupling device equipped with the direct-acting guide to which it shows the above-mentioned plate of each other which carries out contiguity to the radial direction of a disc.

[Claim 26]
The in wheel motor system according to claim 7 characterized by combining the revolution side case of a motor with a wheel through the plate of hollow discoid which equipped the motor and wheel side with two or more direct-acting guides, respectively while combining the nonrotation side case which supports the stator of the above-mentioned motor with the knuckle which are the axle part components of a vehicle through a buffer member or a shock absorber.

[Claim 27]
The in wheel motor system according to claim 26 characterized by being 90 degrees or 180-degree spacing, and having arranged the above-mentioned direct-acting guide on the periphery of the plate of hollow discoid in the table of the above-mentioned plate, and hidden homotopic, respectively.

[Claim 28]
The in wheel motor system according to claim 27 characterized by having made the operation direction of all the direct-acting guides by the side of the above-mentioned motor into the direction of 45 degree to the direction of a path of the plate of hollow discoid, and making the operation direction of all the direct-acting guides by the side of the above-mentioned wheel into the direction which intersects perpendicularly to the operation direction of the direct-acting guide by the side of the above-mentioned motor.

[Claim 29]
While combining the nonrotation side case which supports the stator of the above-mentioned motor with the knuckle which are the axle part components of a vehicle through a buffer member or a shock absorber The 1st plate of hollow discoid which equipped the motor and wheel side with two or more direct-acting guides for the revolution side case of a motor, respectively, this 1st hollow -- it arranges inside a disc-like plate -- having -- two or more direct-acting guides -- the 1st hollow of the above -- a disc-like plate -- a table and a flesh side -- the 2nd hollow arranged conversely -- the in wheel motor system according to claim 7 characterized by making it combine with a wheel through a disc-like plate.

[Claim 30]
The above-mentioned direct-acting guide on the periphery of the 1st and 2nd plates of hollow discoid, respectively at intervals of 90 degrees or 180 degrees And while arranging to the table of the above-mentioned plate, and hidden homotopic, respectively The operation direction of all the direct-acting guides by the side of the motor of the plate of the 1st and 2nd hollow discoid of the above is made into the direction of 45 degree to the direction of a path of each above-mentioned plate. The in wheel motor system according to claim 29 characterized by making the operation direction of all the direct-acting guides by the side of the wheel of each above-mentioned plate into the direction which intersects perpendicularly to the operation direction of the direct-acting guide by the side of the above-mentioned motor.

[Claim 31]
The in wheel motor system according to claim 30 characterized by making equal mass of the plate of

the 1st and 2nd hollow discoid of the above.

[Claim 32]
The in wheel motor system according to claim 24 to 31 characterized by constituting from a guide rail which has at least one crevice or heights which extends the above-mentioned direct-acting guide to the radial direction of the above-mentioned plate, and a guide member which engages with this guide rail.

[Claim 33]
The in wheel motor system according to claim 32 characterized by arranging a shot between the above-mentioned guide rail and a guide member.

[Claim 34]
The in wheel motor system according to claim 24 to 31 characterized by arranging a movable shot along the above-mentioned slot between the above-mentioned plates, and showing the above-mentioned plate of each other which carries out contiguity to the radial direction of a disc while establishing the slot cut off by the radial direction in the field which counters mutually [ the above-mentioned plate ].

[Claim 35]
The in wheel motor system according to claim 24 to 34 by which it is characterized by having arranged the above-mentioned plate as the angle which the above-mentioned direct-acting guide which adjoins the shaft orientations of a plate, or slots make when the number of sheets of the above-mentioned plate is set to N carries out an every tooth lead angle whenever [ 180/(N-1) ] from an edge.

[Claim 36]
The nonrotation side case which supports the stator of the above-mentioned motor, and the knuckle which are the axle part components of a vehicle The edge of one arm combined with the above-mentioned nonrotation side case, and combined with the knuckle whose edges of the arm of another side are the axle part components of a vehicle. Have two arms each other combined pivotable, and combine two above-mentioned arms with a spring and a damper, and change. The in wheel motor system according to claim 7 characterized by making it join together by the buffer member equipped with the link mechanism of at least 1 set of abbreviation A molds, or H mold.

[Claim 37]
While having an axle type suspension device, the nonrotation side case and axle which support the stator of the above-mentioned motor The edge of one arm combined with the above-mentioned nonrotation side case, and the edge of the arm of another side combined with the axle. Have two arms each other combined pivotable, and combine two above-mentioned arms with a spring and a damper, and change. The in wheel motor system according to claim 7 characterized by making it join together by the buffer member equipped with the link mechanism of at least 1 set of abbreviation A molds, or H mold.

[Claim 38]
The in wheel motor system according to claim 7 characterized by combining two above-mentioned plates with the spring and damper which operate to vehicle up down one while combining the above-mentioned nonrotation side case and the knuckle with two plates with which the actuation direction was mutually limited to vehicle up down one through the direct-acting guide.

[Claim 39]
The in wheel motor system according to claim 7 characterized by making the above-mentioned shock absorber into the structure equipped with the bulb between the oil hydraulic cylinder and the reservoir tank while supporting the above-mentioned motor rockable through the direct-acting guide and the shock absorber to the knuckle and the vehicle up down one which are the axle part components of a vehicle.

[Claim 40]
The in wheel motor system according to claim 39 characterized by having the hydraulic oil passage where the piston top room of the above-mentioned oil hydraulic cylinder and the bottom room of a piston were equipped with the independent bulb and the reservoir tank, respectively.

[Claim 41]
The in wheel motor system according to claim 39 characterized by having the hydraulic oil passage where the piston top room of the above-mentioned oil hydraulic cylinder and the bottom room of a

piston were equipped with the independent bulb, respectively, and connecting the two above-mentioned hydraulic oil passage to a common reservoir tank.

[Claim 42]

The in wheel motor system according to claim 39 characterized by being connected by the hydraulic oil passage where the piston top room of the above-mentioned oil hydraulic cylinder and the bottom room of a piston were equipped with the independent bulb, respectively, and connecting the bottom room of a piston to a reservoir tank.

[Claim 43]

The in wheel motor system according to claim 7 to 42 characterized by equipping the hub section with a linkage with a mounted power engine output shaft.

[Claim 44]

The in wheel motor system according to claim 7 to 43 characterized by using the above-mentioned motor as an outer rotor mold motor.

[Claim 45]

The in wheel motor system according to claim 7 to 43 characterized by using the above-mentioned motor as an inner rotor mold motor.

[Claim 46]

The in wheel motor system characterized by to connect a reducer output shaft and a wheel by the shaft which has a universal joint while equipping the wheel section with the electric motor , using the above-mentioned motor as the geared motor which combined the inner rotor mold motor and the reduction gear of a hollow configuration in the in wheel motor system which drives a wheel by the above-mentioned motor and combining the nonrotation side case of this geared motor , and the knuckle which are the axle-part components of a vehicle through the buffer member .

[Claim 47]

The in wheel motor system according to claim 46 characterized by preparing the direct-acting guide to which it shows the above-mentioned motor in the vertical direction between the above-mentioned nonrotation side case and a knuckle.

[Claim 48]

In the in wheel motor system which equips the wheel section with the electric motor of a hollow configuration, and drives a wheel by the above-mentioned motor Inside [ direction of path ] the 1st annular case where the direction inside of a path was opened, and this 1st annular case The inside of the 2nd annular case where the direction outside of a path arranged concentric circular [ of the above 1st / the annular case and concentric circular / annular ] was opened, Attach a motor stator in one case and this is made into a nonrotation side case. While separating the above-mentioned motor stator and predetermined spacing, attaching a motor rotor, making this into a revolution side case and connecting the above-mentioned nonrotation side case and a revolution side case with the case of another side pivotable through a bearing The in wheel motor system characterized by having combined the above-mentioned nonrotation side case with the knuckle which are the axle part components of a vehicle, and combining the above-mentioned revolution side case with a wheel.

[Claim 49]

The in wheel motor system according to claim 48 characterized by having a wheel support device inside a motor while combining the nonrotation side case which supports the stator of the outer rotor mold motor of a hollow configuration with the knuckle which are the axle part components of a vehicle and combining with a wheel the revolution side case which supports Rota.

[Claim 50]

The in wheel motor system according to claim 49 characterized by combining the hub section connected with the revolving shaft of the above-mentioned knuckle and the above-mentioned wheel through the hub bearing in which it was prepared inside the motor of the above-mentioned hollow configuration, and supporting the above-mentioned wheel while making the revolution side case inscribed in a wheel.

[Claim 51]

The in wheel motor system according to claim 49 or 50 characterized by combining the above-mentioned revolution side case with a wheel through an elastic body.

[Claim 52]

The in wheel motor system according to claim 51 characterized by setting to 1MPa-120MPa the

modulus of direct elasticity of the ingredient which constitutes the above-mentioned elastic body.
[Claim 53]
The in wheel motor system according to claim 48 to 52 characterized by equipping the hub section with a brake disc or a brake drum.
[Claim 54]
The in wheel motor system according to claim 48 to 52 characterized by equipping the hub section with a linkage with a mounted power engine output shaft.
[Claim 55]
In the in wheel motor system which equips the wheel section with the electric motor of a hollow configuration, and drives a wheel by the above-mentioned motor While supporting the above-mentioned motor to vehicle up down one to the knuckle which are the axle part components of a vehicle and supporting it also to a vehicle cross direction to the above-mentioned knuckle through a direct-acting guide and a buffer member through a direct-acting guide and a buffer member The in wheel motor system characterized by combining the revolution side case and wheel of a motor possible [ eccentricity ] through rectangular coupling or a constant-velocity joint.
[Claim 56]
The in wheel motor system according to claim 55 characterized by using the above-mentioned motor as an outer rotor mold motor.
[Claim 57]
The in wheel motor system according to claim 55 characterized by using the above-mentioned motor as an inner rotor mold motor.
[Claim 58]
In the in wheel motor system which equips the wheel section with an electric motor and drives a wheel by the above-mentioned motor Use the above-mentioned motor as the geared motor which combined the inner rotor mold motor and reduction gear of a hollow configuration, and a direct-acting guide and a buffer member are minded for the nonrotation side case of this geared motor. While supporting to vehicle up down one to the knuckle which are the axle part components of a vehicle and supporting also to a vehicle cross direction to the above-mentioned knuckle through a direct-acting guide and a buffer member The in wheel motor system characterized by connecting a reducer output shaft and a wheel by the shaft which has a universal joint.

[Translation done.]

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
This invention relates to the means of attachment of the in wheel motor system used in the vehicle which uses a direct-drive wheel as a driving wheel, and an in wheel motor.
[Background of the Invention]
[0002]
In recent years, in the vehicle driven by motors, such as an electric vehicle, the in wheel motor system which contains a motor in a wheel is being adopted from the height of space efficiency, and the height of the transmission efficiency of driving force.
Drawing 78 is drawing showing the anchoring condition of the outer rotor mold direct drive motor (in wheel motor) 70 of the conventional hollow configuration, and in this in wheel motor 70, stator 70S are connected and supported by the upright 71 which is a fixed part, are arranged inside the wheel disc 73 of the direct-drive wheel 72, and are combined by bearing 74J in the revolving shaft 74 connected with the above-mentioned wheel disc 73. Moreover, Rota 70R arranged at the periphery side of above-mentioned stator 70S is supported by 1st bracket 75a combined with the above-mentioned revolving shaft 74, and the above-mentioned upright 71 and 2nd bracket 75b fixed pivotable through bearing 71J. Thereby, since Rota 70R is combined pivotable to stator 70S, by driving the in wheel motor 70, turning effort can be transmitted to a wheel 72 and it becomes possible to carry out the direct drive of the wheel 72 (for example, patent reference 1 reference).
[0003]
An in wheel motor attaches. Moreover, as a direction As shown in drawing 79 , inside the housing 82 fixed to the wheel 81 Rota 80R which has magnetic means (permanent magnet) 80M is carried. Inside the above-mentioned magnetic means 80M While attaching in the shaft 84 of the shape of hollow by which these stator 80S were connected with the knuckle 83 which arranges stator 80S which have coil 80C fixed The side attachment walls 82a and 82b of the inside of the above-mentioned housing 82, and an outside by combining with the above-mentioned stator 80S through bearings 84a and 84b As Rota 80R of the in wheel motor 80 is shown in the approach (for example, patent reference 2 reference) of combining pivotable to stator 80S, and drawing 80 While fixing stator 90S of the in wheel motor 90 to the steering knuckle 93 joined to the hub section 92 through the bearing 91 Rim section 94a of a wheel 94 is operated as Rota of a motor, and this approach (for example, patent reference 3 reference) of combining Rota (rim section 94a) and stator 90S pivotable etc. is proposed.
[0004]
On the other hand, when it runs a concavo-convex way, the touch-down force of a tire is changed, and road-holding nature gets worse, so that the mass of the components which generally correspond under springs, such as a wheel, a knuckle, and a suspension arm, in the vehicle which equipped axle part with suspension devices, such as a spring, and the so-called nonsuspended mass are large. Moreover, also when the so-called sprung mass [ say / the body of a vehicle ] is small, road-holding nature gets worse. For this reason, in order to raise road-holding nature, reduction of the nonsuspended mass to sprung mass is indispensable.
[Patent reference 1] The patent No. 2676025 official report

[Patent reference 2] Patent Publication Heisei No. 506236 [ nine to ] official report
[Patent reference 3] JP,10-305735,A
[Description of the Invention]
[Problem(s) to be Solved by the Invention]
[0005]
However, in an in wheel motor, since a motor stator part was fixed to the spindle shaft linked to the
components called the upright or knuckle which is one of the components which constitute the axle
part of a vehicle pivotable as mentioned above, nonsuspended mass increased by loading of the
above-mentioned in wheel motor, and there was a trouble that road-holding nature will get worse.
Therefore, though an in wheel motor vehicle is fundamentally excellent in space efficiency or the
transmission efficiency of driving force and is packaging attractive as an electric vehicle, the
example of adoption has current [ very little ].
[0006]
This invention was made in view of the conventional trouble, reduces fluctuation of the tire touch-
down force of a vehicle, and aims at offering the means of attachment of an in wheel motor and the
in wheel motor system which can raise the road-holding nature of a vehicle.
[Means for Solving the Problem]
[0007]
In case the means of attachment of the in wheel motor of this invention according to claim 1 attach
an in wheel motor in a direct-drive wheel, they are characterized by attaching the above-mentioned
motor in the vehicle spring lower part through a buffer member or a shock absorber.
Here, the vehicle spring lower part points out the member which constitutes the axle part section of
vehicles, such as a wheel, and a knuckle, a suspension arm.
The means of attachment of an in wheel motor according to claim 2 are characterized by having
combined the nonrotation side case and knuckle of the above-mentioned motor through the 1st
elastic body, and combining a revolution side case and a wheel through the 2nd elastic body in the
means of attachment of an in wheel motor according to claim 1.
The means of attachment of an in wheel motor according to claim 3 are characterized by having
combined the nonrotation side case which supports the stator of the above-mentioned motor, and the
knuckle which are the axle part components of a vehicle according to the direct-acting guide device,
and combining with the radial direction of a wheel the revolution side case which supports Rota of
the above-mentioned motor, and the wheel of each other according to the driving force transfer
device in which eccentricity is possible in the means of attachment of an in wheel motor according to
claim 1.
The means of attachment of an in wheel motor according to claim 4 are characterized by having
combined the nonrotation side case and knuckle of the above-mentioned motor through the direct-
acting guide device containing a damper, and combining a revolution side case and a wheel through
the 2nd elastic body in the means of attachment of an in wheel motor according to claim 1.
In case the means of attachment of an in wheel motor according to claim 5 attach an in wheel motor
in a direct-drive wheel, they are characterized by attaching the nonrotation side case of the above-
mentioned motor in a car-body side through a shock absorber.
It is characterized by the means of attachment of an in wheel motor according to claim 6 attaching
the above-mentioned motor so that the resonance frequency of the motor section attached the
account of a top may be higher than the resonance frequency of the vehicle spring upper part (car
body) in the means of attachment of an in wheel motor according to claim 1 to 5 and it may become
a frequency lower than the resonance frequency of the spring lower part.
[0008]
Moreover, an in wheel motor system according to claim 7 equips the wheel section with the electric
motor of a hollow configuration, and is characterized by attaching the above-mentioned motor in
either a vehicle spring lower part side and a car-body side and both through a buffer member or a
shock absorber, and changing in the in wheel motor system which drives a wheel by the above-
mentioned motor.
An in wheel motor system according to claim 8 combines a motor and the wheel of each other with a
constant-velocity joint or the radial direction of a wheel in an in wheel motor system according to

claim 7 according to the driving force transfer device in which eccentricity is possible.

In an in wheel motor system according to claim 8, the coupling device equipped with the direct-acting guide which shows the above-mentioned plate of each other which carries out contiguity to the radial direction of a disc constitutes an in wheel motor system according to claim 9 while it combines between the above-mentioned plates which adjoin two or more plates of hollow discoid in the above-mentioned driving force transfer device.

An in wheel motor system according to claim 10 combines the nonrotation side case which supports the stator of the above-mentioned motor, and the knuckle which are the axle part components of a vehicle according to a direct-acting guide device in an in wheel motor system according to claim 7 to 9.

An in wheel motor system according to claim 11 forms a buffer member or a shock absorber in at least one side or both between the nonrotation side case of the above-mentioned motor, and a knuckle, and between a revolution side case and a wheel in an in wheel motor system according to claim 7 to 10.

[0009]

In an in wheel motor system according to claim 7, an in wheel motor system according to claim 12 combines the revolution side case and wheel which support Rota through the 2nd elastic body while combining the nonrotation side case which supports the stator of the above-mentioned motor, and the knuckle which are the axle part components of a vehicle through the 1st elastic body.

An in wheel motor system according to claim 13 constitutes both the 1st and 2nd both [ at least one side or ] of the above by the pneumatic spring in an in wheel motor system according to claim 12.

In an in wheel motor system according to claim 12, an in wheel motor system according to claim 14 combines the end of this cylinder with a wheel, and combines the other end with a revolution side case while it makes the 2nd elastic body of the above cylindrical.

An in wheel motor system according to claim 15 combines a wheel and a revolution side case in an in wheel motor system according to claim 12 with 16 or less abbreviation tabular elastic bodies arranged at equal intervals in parallel with a wheel tangential direction.

An in wheel motor system according to claim 16 prepares the revolution splice hand-loom style centering on the tangential direction of a motor in the ends side of the cross direction of the above-mentioned tabular elastic body in an in wheel motor system according to claim 15.

An in wheel motor system according to claim 17 combines the rib extended in the direction of the wheel section from a revolution side case, and the rib extended in the direction of a revolution side case from a wheel with an elastic body in two or more places in an in wheel motor system according to claim 12.

An in wheel motor system according to claim 18 sets to 1MPa-120MPa the modulus of direct elasticity of the ingredient which constitutes the 1st and 2nd elastic bodies of the above in an in wheel motor system according to claim 12 to 17.

An in wheel motor system according to claim 19 sets to 10GPa-300GPa the modulus of direct elasticity of the ingredient which constitutes the 1st and 2nd elastic bodies of the above in an in wheel motor system according to claim 12 to 17.

An in wheel motor system according to claim 20 makes the elastic modulus of the vertical direction lower than the elastic modulus of a cross direction to the vehicle of the 1st elastic body of the above in an in wheel motor system according to claim 12 to 19.

An in wheel motor system according to claim 21 is replaced with the 1st elastic body of the above in an in wheel motor system according to claim 12 to 20, and the above-mentioned nonrotation side case is combined with a knuckle through the direct-acting guide device equipped with the spring and the damper.

An in wheel motor system according to claim 22 combines the above-mentioned revolution side case with a wheel through a constant-velocity joint in an in wheel motor system according to claim 12 to 21.

An in wheel motor system according to claim 23 attaches the 2nd elastic body in the center-of-mass location of the above-mentioned motor in the motor cross direction in an in wheel motor system given in above-mentioned claim 22.

In an in wheel motor system according to claim 12 to 21, an in wheel motor system according to

claim 24 is combined with a wheel through the coupling device equipped with the direct-acting guide which shows the above-mentioned plate of each other which carries out contiguity to the radial direction of a disc while it combines between the above-mentioned plates which adjoin two or more plates of hollow discoid in the above-mentioned revolution side case.
[0010]
An in wheel motor system according to claim 25 While combining the nonrotation side case which supports the stator of the above-mentioned motor with the knuckle which are the axle part components of a vehicle through a buffer member or a shock absorber in an in wheel motor system according to claim 7 While combining between the above-mentioned plates which adjoin two or more plates of hollow discoid in the revolution side case of a motor, it is made to combine with a wheel through the coupling device equipped with the direct-acting guide which shows the above-mentioned plate of each other which carries out contiguity to the radial direction of a disc.
In an in wheel motor system according to claim 7, an in wheel motor system according to claim 26 combines the revolution side case of a motor with a wheel through the plate of hollow discoid which equipped the motor and wheel side with two or more direct-acting guides, respectively while combining the nonrotation side case which supports the stator of the above-mentioned motor with the knuckle which are the axle part components of a vehicle through a buffer member or a shock absorber.
In an in wheel motor system according to claim 26, on the periphery of the plate of hollow discoid, an in wheel motor system according to claim 27 is 90 degrees or 180-degree spacing, and arranges the above-mentioned direct-acting guide in the table of the above-mentioned plate, and hidden homotopic, respectively.
In an in wheel motor system according to claim 27, an in wheel motor system according to claim 28 makes the operation direction of all the direct-acting guides by the side of the above-mentioned motor the direction of 45 degree to the direction of a path of the plate of hollow discoid, and makes the operation direction of all the direct-acting guides by the side of the above-mentioned wheel the direction which intersects perpendicularly to the operation direction of the direct-acting guide by the side of the above-mentioned motor.
[0011]
An in wheel motor system according to claim 29 While combining the nonrotation side case which supports the stator of the above-mentioned motor with the knuckle which are the axle part components of a vehicle through a buffer member or a shock absorber in an in wheel motor system according to claim 7 The 1st plate of hollow discoid which equipped the motor and wheel side with two or more direct-acting guides for the revolution side case of a motor, respectively, this 1st hollow -- it arranges inside a disc-like plate -- having -- two or more direct-acting guides -- the 1st hollow of the above -- a disc-like plate -- a table and a flesh side -- the 2nd hollow arranged conversely -- it is made to combine with a wheel through a disc-like plate
An in wheel motor system according to claim 30 In an in wheel motor system according to claim 29 the above-mentioned direct-acting guide on the periphery of the 1st and 2nd plates of hollow discoid, respectively at intervals of 90 degrees or 180 degrees And while arranging to the table of the above-mentioned plate, and hidden homotopic, respectively The operation direction of all the direct-acting guides by the side of the motor of the plate of the 1st and 2nd hollow discoid of the above is made into the direction of 45 degree to the direction of a path of each above-mentioned plate. The operation direction of all the direct-acting guides by the side of the wheel of each above-mentioned plate is made into the direction which intersects perpendicularly to the operation direction of the direct-acting guide by the side of the above-mentioned motor.
An in wheel motor system according to claim 31 makes equal mass of the plate of the 1st and 2nd hollow discoid of the above in an in wheel motor system according to claim 30.
An in wheel motor system according to claim 32 consists of a guide rail which has at least one crevice or heights which extends the above-mentioned direct-acting guide to the radial direction of the above-mentioned plate, and a guide member which engages with this guide rail in an in wheel motor system according to claim 24 to 31.
An in wheel motor system according to claim 33 arranges a shot between the above-mentioned guide rail and a guide member in an in wheel motor system according to claim 32.

In an in wheel motor system according to claim 24 to 31, an in wheel motor system according to claim 34 arranges a movable shot along the above-mentioned slot between the above-mentioned plates, and shows the above-mentioned plate of each other which carries out contiguity to the radial direction of a disc while it establishes the slot cut off by the radial direction in the field which counters mutually [ the above-mentioned plate ].

In an in wheel motor system according to claim 24 to 34, when the number of sheets of the above-mentioned plate is set to N, an in wheel motor system according to claim 35 arranges the above-mentioned plate so that the angle which the above-mentioned direct-acting guide which adjoins the shaft orientations of a plate, or slots make may carry out an every tooth lead angle whenever [ 180/ (N-1) ] from an edge.

[0012]

An in wheel motor system according to claim 36 In an in wheel motor system according to claim 7, the nonrotation side case which supports the stator of the above-mentioned motor, and the knuckle which are the axle part components of a vehicle The edge of one arm combined with the above-mentioned nonrotation side case, and combined with the knuckle whose edges of the arm of another side are the axle part components of a vehicle. It is made to join together by the buffer member equipped with the link mechanism of at least 1 set of abbreviation A molds which have two arms each other combined pivotable, and combine two above-mentioned arms with a spring and a damper, and change, or H mold.

An in wheel motor system according to claim 37 In an in wheel motor system according to claim 7, while having an axle type suspension device The edge of one arm combines with the above-mentioned nonrotation side case the nonrotation side case and axle which support the stator of the above-mentioned motor. It is made to join together by the buffer member equipped with the link mechanism of at least 1 set of abbreviation A molds which have two arms which the edge of the arm of another side combined with the axle, and which were combined pivotable, and combine two above-mentioned arms with a spring and a damper, and change, or H mold.

In an in wheel motor system according to claim 7, an in wheel motor system according to claim 38 combines two above-mentioned plates with the spring and damper which operate to vehicle up down one while combining the above-mentioned nonrotation side case and a knuckle with two plates with which the actuation direction was mutually limited to vehicle up down one through the direct-acting guide.

[0013]

In an in wheel motor system according to claim 7, an in wheel motor system according to claim 39 makes the above-mentioned shock absorber the structure equipped with the bulb between the oil hydraulic cylinder and the reservoir tank while supporting the above-mentioned motor rockable through a direct-acting guide and a shock absorber to the knuckle and the vehicle up down ones which are the axle part components of a vehicle.

An in wheel motor system according to claim 40 has the hydraulic oil passage where the piston top room of the above-mentioned oil hydraulic cylinder and the bottom room of a piston were equipped with the independent bulb and the reservoir tank, respectively in an in wheel motor system according to claim 39.

An in wheel motor system according to claim 41 has the hydraulic oil passage where the piston top room of the above-mentioned oil hydraulic cylinder and the bottom room of a piston were equipped with the independent bulb in the in wheel motor system according to claim 39, respectively, and the two above-mentioned hydraulic oil passage is connected to the common reservoir tank.

An in wheel motor system according to claim 42 is connected by the hydraulic oil passage where the piston top room of the above-mentioned oil hydraulic cylinder and the bottom room of a piston were equipped with the independent bulb in the in wheel motor system according to claim 39, respectively, and the reservoir tank is connected to the bottom room of a piston.

An in wheel motor system according to claim 43 equips the hub section with a linkage with a mounted power engine output shaft in an in wheel motor system according to claim 7 to 42.

An in wheel motor system according to claim 44 uses the above-mentioned motor as an outer rotor mold motor in an in wheel motor system according to claim 7 to 43.

An in wheel motor system according to claim 45 uses the above-mentioned motor as an inner rotor

mold motor in an in wheel motor system according to claim 7 to 43.
[0014]
An in wheel motor system according to claim 46 In the in wheel motor system which equips the wheel section with an electric motor and drives a wheel by the above-mentioned motor Use the above-mentioned motor as the geared motor which combined the inner rotor mold motor and reduction gear of a hollow configuration, and while joining together through a buffer member, the nonrotation side case of this geared motor, and the knuckle which are the axle part components of a vehicle It is characterized by connecting a reducer output shaft and a wheel by the shaft which has a universal joint.
An in wheel motor system according to claim 47 prepares the direct-acting guide to which it shows the above-mentioned motor in the vertical direction between the above-mentioned nonrotation side case and a knuckle in an in wheel motor system according to claim 46.
[0015]
An in wheel motor system according to claim 48 In the in wheel motor system which equips the wheel section with the electric motor of a hollow configuration, and drives a wheel by the above-mentioned motor Inside [ direction of path ] the 1st annular case where the direction inside of a path was opened, and this 1st annular case The inside of the 2nd annular case where the direction outside of a path arranged concentric circular [ of the above 1st / the annular case and concentric circular / annular ] was opened, Attach a motor stator in one case and this is made into a nonrotation side case. While separating the above-mentioned motor stator and predetermined spacing, attaching a motor rotor, making this into a revolution side case and connecting the above-mentioned nonrotation side case and a revolution side case with the case of another side pivotable through a bearing It is characterized by having combined the above-mentioned nonrotation side case with the knuckle which are the axle part components of a vehicle, and combining the above-mentioned revolution side case with a wheel.
In an in wheel motor system according to claim 48, an in wheel motor system according to claim 49 is characterized by having a wheel support device inside a motor while it combines the nonrotation side case which supports the stator of the outer rotor mold motor of a hollow configuration with the knuckle which are the axle part components of a vehicle and combines with a wheel the revolution side case which supports Rota.
In an in wheel motor system according to claim 49, an in wheel motor system according to claim 50 combines the hub section connected with the revolving shaft of the above-mentioned knuckle and the above-mentioned wheel through the hub bearing in which it was prepared inside the motor of the above-mentioned hollow configuration, and supports the above-mentioned wheel while it makes a revolution side case inscribed in a wheel.
An in wheel motor system according to claim 51 combines the above-mentioned revolution side case with a wheel through an elastic body in an in wheel motor system according to claim 49 or 50.
An in wheel motor system according to claim 52 sets to 1MPa-120MPa the modulus of direct elasticity of the ingredient which constitutes the above-mentioned elastic body in an in wheel motor system according to claim 51.
An in wheel motor system according to claim 53 equips the hub section with a brake disc or a brake drum in an in wheel motor system according to claim 48 to 52.
An in wheel motor system according to claim 54 equips the hub section with a linkage with a mounted power engine output shaft in an in wheel motor system according to claim 48 to 52.
[0016]
An in wheel motor system according to claim 55 In the in wheel motor system which equips the wheel section with the electric motor of a hollow configuration, and drives a wheel by the above-mentioned motor While supporting the above-mentioned motor to vehicle up down one to the knuckle which are the axle part components of a vehicle through a direct-acting guide and a buffer member and supporting it also to a vehicle cross direction to the above-mentioned knuckle through a direct-acting guide and a buffer member It is characterized by combining the revolution side case and wheel of a motor possible [ eccentricity ] through rectangular coupling or a constant-velocity joint.
An in wheel motor system according to claim 56 uses the above-mentioned motor as an outer rotor

mold motor in an in wheel motor system according to claim 55.

An in wheel motor system according to claim 57 uses the above-mentioned motor as an inner rotor mold motor in an in wheel motor system according to claim 55.

An in wheel motor system according to claim 58 In the in wheel motor system which equips the wheel section with an electric motor and drives a wheel by the above-mentioned motor Use the above-mentioned motor as the geared motor which combined the inner rotor mold motor and reduction gear of a hollow configuration, and a direct-acting guide and a buffer member are minded for the nonrotation side case of this geared motor. While supporting to vehicle up down one to the knuckle which are the axle part components of a vehicle and supporting also to a vehicle cross direction to the above-mentioned knuckle through a direct-acting guide and a buffer member It is characterized by connecting a reducer output shaft and a wheel by the shaft which has a universal joint.

[Effect of the Invention]

[0017]

In case an in wheel motor is attached in a direct-drive wheel according to this invention, a buffer member or a shock absorber is minded for the above-mentioned motor. Since it was made to make anchoring and an in wheel motor act on the spring lower part of a vehicle as weight of a tuned damper to nonsuspended mass While being able to reduce the fluctuation level of the touch-down force at the time of concavo-convex way transit of a vehicle and being able to raise the road-holding nature of a vehicle, the oscillating load to an in / wheel motor can be reduced.

[Best Mode of Carrying Out the Invention]

[0018]

Hereafter, the best gestalt of this invention is explained based on a drawing.

The best gestalt 1

Drawing 1 and drawing 2 are drawings showing the in wheel motor structure of a system concerning the gestalt 1 best [ this ], drawing 1 is drawing of longitudinal section, and drawing 2 is a transverse-plane sectional view. The wheel to which a tire and 2 change from rim 2a and wheel-disc 2b in each drawing in 1, and motor stator (henceforth stator) 3S which were fixed to nonrotation side case 3a which 3 received radially and was prepared inside, The motor rotor fixed to revolution side case 3b which received radially, was prepared outside and fixed pivotable to the above-mentioned nonrotation side case 3a through bearing 3j (It is hereafter called Rota) By the in wheel motor of the outer rotor mold equipped with 3R, air gap 3g is formed between the above-mentioned Rota 3R and stator 3S. The hub section with which 4 was connected in the above-mentioned wheel 2 and its revolving shaft, the knuckle by which 5 is connected with the up-and-down suspension arms 6a and 6b, the suspension member to which 7 changes from a shock absorber etc., and 8 are damping devices which consist of the brake disc equipped with brake rotor 8a with which the above-mentioned hub section 4 was equipped, and brake caliper 8b. In addition, other damping devices, such as a brake drum, may be used as a damping device 8.

[0019]

The 1st elastic member 11 which consists nonrotation side case 3a which fixed stator 3S of the above-mentioned in wheel motor 3 of elastic bodies, such as rubber, in this example, The connection member 12 which has two or more arm 12b which extends the 1st elastic member 11 of the above in the knuckle 5 direction from supporter material 12a supported from the radial inside and above-mentioned supporter material 12a is minded. While combining with the knuckle 5 which are the axle part components of a vehicle, the 2nd elastic member 13 is minded for revolution side case 3b which was combined pivotable through the above-mentioned nonrotation side case 3a and bearing 3j and which fixed Rota 3R. It is made to carry out floating mounting of the in wheel motor 3 by combining with a wheel 2 to each part article of the vehicle axle part section of knuckle 5 grade.

Therefore, the revolving shaft of the above-mentioned in wheel motor 3 becomes independently rockable in the direction of a path with the revolving shaft of a wheel 2. That is, turning effort is transmitted to the wheel 2 which above-mentioned revolution side case to which Rota 3R was fixed while revolving shaft of above-mentioned in wheel motor 3 rocked axle in direction of path separately, since [ it was divided pivotable to the direction outside of a path and the inside through / as the in wheel motor 3 is shown in drawing 3 / bearing 3j ], and 3b rotates, and is equipped with a

vehicle, the oscillating load to the in wheel motor 3 can be reduced.
Moreover, it becomes possible by adopting the in wheel motor system of this invention to excel in space efficiency or the transmission efficiency of driving force, and to realize the good in wheel motor vehicle of the road-holding nature of a vehicle.
[0024]
In addition, with the above-mentioned best gestalt 1, although anchoring side and revolution side case 3b was explained to the knuckle 5 about the mounting beam case through the 2nd elastic member 13 at the wheel 2 through the 1st elastic member 11, nonrotation side case 3a of the in wheel motor 3 It replaces with the 1st and 2nd elastic members 11 and 13 of the above, and if the annular pneumatic springs 11T and 13T of the shape of a tire as shown in drawing 6 are used, since the load rate of the direction of a path can make the load rate of the shearing direction high comparatively [ low ], the elastic member of lightweight high elasticity can be constituted.
Moreover, it replaces with the 1st elastic member 11 of the above, and the connection member 12, and you may make it make it join together according to the direct-acting guide device 14 equipped with supporter material 14b which supports damper 14a and this damper 14a for nonrotation side case 3a and a knuckle 5 in the vertical direction of a vehicle, as shown in drawing 7 and drawing 8 . Since the in wheel motor 3 can be restrained in the vertical motion direction by this, generating damping force, the circumference of the companion of a wheel 2 and the in wheel motor 3 can be controlled, and revolution actuation effectiveness can be raised.
[0025]
Moreover, Rota side rib 2m which crosses on the periphery of a wheel 2 and is extended from revolution side case 3b to a wheel 2-way at equal intervals as shown in drawing 9 , By combining wheel side rib 2n extended in the above-mentioned revolution side case 3b direction through an elastic body 15 from a wheel 2 Since a rigid shearing spring with low vertical motion and a hand of cut can use as a rigid high compression tension spring the spring which combines a wheel 2 and the in wheel motor 3 The in wheel motor 3 can be rocked only in the abbreviation vertical direction, and the circumference of a companion with a wheel 2 can be controlled further.
Or as shown in drawing 10 , it replaces with the 2nd elastic member 13 of the above as an elastic body which combines a wheel 2 and revolution side case 3b, 13h of one fields of the above-mentioned elastic body 13R is combined with a wheel 2 using cylinder-like elastic body 13R, and you may make it combine 13m of fields of another side with revolution side case 3b. Since it acts as a shearing spring accompanied by a shear strain and rigidity becomes [ rigidity ] high in a hand of cut low in a radial direction in case vertical motion and torque transmission of the in wheel motor 3 are carried out, cylinder elastic body 13R of the above can raise revolution actuation effectiveness.
[0026]
Moreover, as shown in drawing 11 (a), by connecting a wheel 2 and revolution side case 3b with two or more abbreviation tabular elastic bodies 13a-13d arranged at equal intervals in parallel with the tangential direction of a wheel 2, it is low in the rigidity of the vertical direction, and hand-of-cut rigidity can be made high. Namely, when the ends sides 13w and 13w of the above-mentioned tabular elastic bodies [ 13a-13d ] cross direction are attached in a wheel 2 and a wheel 2 and revolution side case 3b are connected Since 13s (field vertical to the direction of a path) of above-mentioned tabular elastic bodies [ 13a-13d ] tabular fields becomes parallel to the hand of cut of the in wheel motor 3 or a wheel 2, rigidity of the direction of a path can be made low and rigidity of a hand of cut can be made high. Adjusting a dimension so that hand-of-cut rigidity may be maintained, about the number, if it carries out, as shown in the graph of drawing 12 , it will become possible an increase and to decrease the rigidity of the vertical direction of the above-mentioned tabular elastic bodies 13a-13d.
Rigidity up down [ above-mentioned ] can be decomposed into the vertical component of radial direction rigidity, and the vertical component of hand-of-cut rigidity. Therefore, although what is necessary is just to make it lower both the vertical component of the above-mentioned radial direction rigidity, and the vertical component of hand-of-cut rigidity in order to reduce the rigidity of the vertical direction, in order for a motor to transmit torque without phase contrast, hand-of-cut rigidity cannot be decreased. Then, as shown in drawing 11 (b), form the revolution splice hand-loom styles 13z and 13z centering on the tangential direction of a motor in the ends sides 13w and

13w of the tabular elastic bodies [ 13a-13d ] cross direction, and these revolution splice hand-loom styles 13z and 13z are minded. It becomes possible to abolish radial direction rigidity and to reduce the rigidity of the vertical direction, without lowering hand-of-cut rigidity, if it carries out as [ attach / in a wheel 2 / the above-mentioned tabular elastic bodies 13a-13d ].
If the above-mentioned tabular elastic bodies 13a-13d make the number increase and go so that hand-of-cut rigidity may be maintained, as shown in the graph of drawing 12 , the rigidity of the vertical direction will also increase them. Therefore, considering as 16 or less pieces is desirable as an above-mentioned tabular elastic bodies [ 13a-13d ] number.
In addition, about the case where elastic body 13R of the shape of a cylinder shown in above-mentioned drawing 10 is prepared as well as the above-mentioned case, in case the end of the above-mentioned elastic body 13R is combined with a wheel 2, the rigidity of the vertical direction can be reduced by preparing the above revolution splice hand-loom styles.
[0027]
Moreover, as shown in drawing 13 , it is good also as a configuration which prepares the connection section with a drive shaft 9 in the hub section 4 connected in a wheel 2 and its revolving shaft, and connects the hub section 4 and a drive shaft 9 with it like the usual automobile. Thereby, since the power from the power engine or motor of mount of those other than in wheel motor 3 can be transmitted to a wheel 2 through the above-mentioned drive shaft 9, it becomes yes, possible, for example by connecting the output shaft of a gasoline engine vehicle to the hub section 4 of the in wheel motor system of this invention to consider as a Brit car.
[0028]
The best gestalt 2
As shown in drawing 14 and drawing 15 , you may make it combine the above-mentioned revolution side case 3b with a wheel 2 through the 2nd elastic member 13 and constant-velocity joint 16 with the above-mentioned best gestalt 1, although revolution side case 3b and a wheel 2 were combined using the 2nd elastic member 13. That is, like the above-mentioned example, if revolution side case 3b and a wheel 2 are combined using an elastic body, since phase contrast arises between a wheel 2 and revolution side case 3b by the shear deformation of a hoop direction, the above-mentioned revolution side case 3b and a wheel 2 will be combined through a constant-velocity joint 16, while joining together by the 2nd elastic member 13 of the above. Rocking the in wheel motor 3 up and down within a wheel 2 by shifting and arranging the center of rotation of wheel side joint 16a, and the center of rotation of motor side joint 16b at this time, from revolution side case 3b, torque is transmitted and the thing of it can be carried out without phase contrast to a wheel 2. Therefore, the above-mentioned phase contrast can be made into min, and the transmission efficiency of the torque from revolution side case 3b to a wheel 2 can be raised.
Furthermore, the above-mentioned phase contrast can be further reduced by connecting according to the direct-acting guide device 14 which consists of damper 14a and supporter material 14b which showed nonrotation side case 3a and a knuckle 5 to drawing 7 of the above-mentioned best gestalt 1, and drawing 8 .
Since the mass of the in wheel motor 3 is committed only as a balance weight, motor mass is not shared with attaching the 2nd elastic member 13 in the center-of-mass location of the motor in the motor cross direction at this time by axle part components.
In addition, when revolution side case 3b and a knuckle 5 are combined using the 1st elastic member 11, in order to make it not make motor mass share with axle part components as shown for example, in above-mentioned drawing 1 instead of the above-mentioned direct-acting guide device 14, it is desirable to attach in the center-of-mass location of the motor in the motor cross direction also about the 1st elastic member 11 of the above.
[0029]
The best gestalt 3
With the above-mentioned best gestalt 2, the transmission efficiency of the torque from revolution side case 3b to a wheel 2 can be further raised by replacing with the above-mentioned constant-velocity joint 16, and combining revolution side case 3b and the wheel 2 of each other with the radial direction of a wheel 2 according to the driving force transfer device in which eccentricity is possible, although revolution side case 3b and a wheel 2 were combined through the 2nd elastic member 13

tire 1.
[0020]
In the above-mentioned configuration, while the mass of the in wheel motor 3 is separated from a wheel 2 or the nonsuspended mass equivalent part of the vehicle of knuckle 5 grade, the above-mentioned mass acts as the so-called weight of a tuned damper to the above-mentioned nonsuspended mass. Therefore, fluctuation of the tire touch-down force at the time of concavo-convex way transit of a vehicle is reduced according to an operation of the above-mentioned tuned damper, and the road-holding nature of a vehicle improves. Moreover, since a direct oscillation is not transmitted to the above-mentioned in wheel motor 3 at the time of bad road transit, the oscillating load to the in wheel motor 3 is reduced.
So that it may become it is higher than the resonance frequency of the spring upper part (car body) of a vehicle in the resonance frequency of the motor section which contains the in wheel motor 3 attached the account of a top at this time, and lower than the resonance frequency of a wheel 2 and the spring lower part containing knuckle 5 grade The fluctuation level of the touch-down force at the time of concavo-convex way transit of a vehicle can be effectively reduced by choosing suitably the elastic coefficient of the 1st and 2nd elastic members 11 and 13 which are the mass and the buffer members of the above-mentioned motor 3 etc., and attaching the above-mentioned motor 3.
[0021]
Moreover, since the load load to the in wheel motor 3 also becomes small in order for the above-mentioned hub section 4 to support the vehicle weight for every wheel by taking this structure, fluctuation of air gap 3g formed between stator 3S and Rota 3R can be made small. Therefore, since the rigidity of above-mentioned nonrotation side case 3a and revolution side case 3b can be lowered, the in wheel motor 3 can be lightweight-ized.
Moreover, since the in wheel motor 3 can be rocked only in the abbreviation vertical direction by setting up the load rate of the direction of a path of the 1st elastic member 11 of the above so that the vertical direction may be made low to a cross direction to a vehicle, the circumference of the companion of a wheel 2 and the in wheel motor 3 can be controlled, and the revolution actuation effectiveness of a wheel can be raised.
[0022]
As the vertical direction is shown in drawing 4 as an approach of making a cross direction high low to a vehicle, for example, elastic members 11a and 11b are arranged only in a cross direction or the load rate of the 1st elastic member 11 of the above is shown in drawing 5 as the 1st elastic member 11, it is realizable by using for a cross direction ellipse-like elastic member 11c which has a major axis etc. In addition, in using ellipse elastic member 11c of the above, as shown in drawing 5 , it also makes the configuration of a knuckle 5 into the shape of the above-mentioned elastic member 11c and isomorphism.
Moreover, in order to make hand-of-cut rigidity high for the vertical direction rigidity low, it is important to make ingredient rigidity and configuration rigidity balance. When spring materials, such as rubber, are used, in order to acquire predetermined rigidity as the 1st elastic member 11 and 2nd elastic member 13 like this example, it is desirable to use the ingredient whose modulus of direct elasticity is 1MPa-120MPa as an ingredient which constitutes the 1st and 2nd elastic members 11 and 13 of the above. Moreover, it is still more desirable if the above-mentioned modulus of direct elasticity is 1MPa-40MPa.
In addition, as the 1st and 2nd elastic members 11 and 13 of the above, when using spring members, such as a metal spring, it is desirable to set to 10GPa-300GPa the modulus of direct elasticity of the ingredient which constitutes the 1st and 2nd elastic members 11 and 13 of the above.
[0023]
Thus, the 1st elastic member 11 attached in the connection member 12 which extends nonrotation side case 3a which fixes stator 3S of the in wheel motor 3 from a knuckle 5 with the gestalt 1 best [ this ] is minded. By making it combine with the knuckle 5 which are the axle part components of a vehicle, and combining with a wheel 2 revolution side case 3b which fixes Rota 3R through the 2nd elastic member 13 Since it was made to make the in wheel motor 3 act as weight of a tuned damper to nonsuspended mass While being able to reduce the fluctuation level of the touch-down force at the time of concavo-convex way transit of a vehicle and being able to raise the road-holding nature of a

and constant-velocity joint 16.

As the above-mentioned driving force transfer device, while combining between two or more plates 18A-18C of hollow discoid as shown in drawing 16 and drawing 17 , the adjoining above-mentioned plates 18A and 18B and plate 18B, and 18C, for example The flexible coupling 18 equipped with the direct-acting guides 18p and 18q to which it shows mutually the above-mentioned plates 18A and 18B which carry out contiguity, and 18B and 18C to the radial direction of a disc can be used. Thus, through the above-mentioned flexible coupling 18, by combining revolution side case 3b with a wheel 2, phase contrast between a wheel 2 and revolution side case 3b can be made into min, and the transmission efficiency of the torque from revolution side case 3b to a wheel 2 can be raised further.

[0030]

As the above-mentioned direct-acting guides 18p and 18q, as shown in drawing 19 , for example Guide-rail 18x which have the heights extended to the radial direction of the above-mentioned plate, In order to make guide member 18y which has the crevice extended to the radial direction of the above-mentioned plate, and engages with the above-mentioned guide-rail 18x, and the above-mentioned guide-rail 18x and guide member 18y slide more smoothly It consists of 18m of two or more shots arranged between the heights of the above-mentioned guide rail, and the crevice of guide member 18y.

The above-mentioned guide-rail 18x and guide member 18y are prepared in the field where the above-mentioned plates 18A and 18B which carry out contiguity, and 18B and 18C counter mutually, respectively, as shown in drawing 18 .

Since the above-mentioned guide-rail 18x and guide member 18y is slid so that it may show mutually the above-mentioned plates 18A and 18B which carry out contiguity, and 18B and 18C to the radial direction of a disc, if there is the in wheel motor 3 along above-mentioned direct-acting guide 18p and the 18q actuation direction, i.e., the radial direction of a disc, it can move, but since it cannot move to a hand of cut, it becomes possible to transmit running torque to a wheel 2 efficiently.

[0031]

Moreover, the above-mentioned in wheel motor 3 can transmit driving torque to a wheel 2 by forming two or more pairs of direct-acting guides 18p and 18q into which the include angle was changed, carrying out eccentricity to every direction to an axle.

Moreover, if there are few direct-acting guides 18p and 18q constituted, since angular-velocity change will arise at the time of a revolution, it is desirable to combine two or more desirable plates and direct-acting guides. In addition, then, if the above-mentioned plates 18A-18C are arranged so that an every tooth lead angle may be carried out 180/(N-1) whenever from direct-acting guide 18p of an edge when the number of sheets of the plate of the above-mentioned hollow discoid is set to N as shown in drawing 18 , generating of the above-mentioned angular-velocity change can be controlled certainly (in this example, since it is N= 3, the above-mentioned include angle turns into 90 degrees).

[0032]

In addition, since the driving force of the in wheel motor 3 is mechanically transmitted to a wheel 2 when it considers as the structure of combining revolution side case 3b and a wheel 2 using the driving force transfer device of a constant-velocity joint 16 or flexible coupling 18 grade mentioned above, as a buffer member for demonstrating the tuned-damper effectiveness, just the 1st elastic member 11 arranged between nonrotation side case 3a and a knuckle 5 is enough.

[0033]

Moreover, flexible coupling 18Z as shows the above-mentioned plates 18A-18C which carry out contiguity to drawing 20 - drawing 22 as a device which it shows to the radial direction of a disc mutually may be used. This flexible coupling 18Z establishes the bearing slots 18a-18c cut off by the radial direction in the field which counters mutually [ the above-mentioned plates 18A-18C ].

Between the plates 18A, 18B, and 18B of hollow discoid which counter, and 18C Respectively, it is what arranged bearing ball 18M which consist of a movable shot along the above-mentioned bearing slots 18a and 18b and the bearing slots 18b and 18c, and the above-mentioned bearing slots 18a and 18b and 18b and 18c, and the above-mentioned bearing ball 18M constitute a direct-acting guide.

That is, since it is formed as rolled in bearing ball 18M to the radial direction of the above-

mentioned plates 18A-18C, the in wheel motor 3 can be moved in the above-mentioned bearing slot 18a - 18c direction, but since it cannot move to a hoop direction, the above-mentioned bearing slots 18a-18c become possible [ transmitting running torque to a wheel 2 efficiently ]. Moreover, the above-mentioned in wheel motor 3 can transmit driving torque to a wheel 2 by combining two or more pairs which changed the include angle of bearing slots 18a-18c, and bearing ball 18M, carrying out eccentricity to every direction to an axle.

[0034]
Moreover, if there are few bearing slots, since angular-velocity change will arise at the time of a revolution, it is desirable to combine two or more desirable plates and bearing balls. In addition, then, like the case of the above-mentioned direct-acting guide, as shown in drawing 22 , when the number of sheets of the above-mentioned plate is set to N, if the angle which the slots which adjoin the shaft orientations of a plate make arranges the plate of the above-mentioned hollow discoid so that an every tooth lead angle may be carried out 180/(N-1) whenever from the slot on the edge, it can control generating of the above-mentioned angular-velocity change certainly.
In addition, it may unite with a wheel 2 and plate 18A by the side of the wheel 2 which is a plate by the side of an edge (or plate 18A and guide-rail 18x) may be constituted, or it unites with revolution side case 3b, and you may make it constitute plate 18C by the side of revolution side case 3b (or plate 18C and guide member 18y) in the above-mentioned flexible couplings 18 and 18Z. At this time, it considers as the value when assuming that a plate is in both ends as number of sheets N of the plate used for count of the above-mentioned tooth lead angle.

[0035]
The best gestalt 4
With the above-mentioned best gestalt 3, as a driving force transfer device which combines revolution side case 3b and a wheel 2 Although the example using the flexible coupling 18 which consists of the plates 18A-18C of each hollow discoid equipped with the direct-acting guides 18p and 18q arranged in the direction in which a table and a flesh side intersect perpendicularly mutually was explained Plate 20A of hollow discoid which is located in the wheel 2 side as shown in drawing 23 and drawing 24 , and is combined with a wheel 2, On each plate periphery by the side of hollow disc-like plate 20C and the motor 3 which are located in a motor 3 side and combined with revolution side case 3b of a motor 3, and a wheel 2, at intervals of 90 degrees or 180 degrees And two or more direct-acting guides 19A and 19B are arranged in the table of a plate, and hidden homotopic, respectively. Direct-acting guide 19A connects with plate 20A of the above-mentioned hollow discoid. You may make it combine revolution side case 3b and a wheel 2 using the flexible coupling 19 which consists of plate 20B of hollow discoid connected with plate 20C of the above-mentioned hollow discoid by direct-acting guide 19B. This offsets the compression and pull strength generated in the hoop direction of a plate, and it becomes possible to abolish the offset in a hoop direction, and while being able to boil the driving torque from the in wheel motor 3 to a wheel 2 and being able to transmit it still more certainly, it becomes possible to raise the endurance of a driving force transfer device.
In this example, the operation direction of direct-acting guide 19B arranged at the motor 3 side is made into the direction of 45 degree to the direction of a path of the plates 20A-20C of hollow discoid, and the operation direction of direct-acting guide 19A arranged at the wheel 2 side is made into the direction which intersects perpendicularly to the operation direction of the above-mentioned direct-acting guide 19B.

[0036]
Moreover, direct-acting guide member 21a which shows nonrotation side case 3a and a knuckle 5 in the vertical direction of a vehicle to the above-mentioned nonrotation side case 3a in this example, Although it was made to connect according to the direct-acting guide device 21 equipped with shock absorber 21b which consists of the spring member expanded and contracted in the operation direction of this direct-acting guide member 21a, and an absorber You may make it connect nonrotation side case 3a and a knuckle 5 using the buffer member of the direct-acting guide device 14 grade equipped with damper 14a shown in drawing 7 and drawing 8 of a gestalt 1 best [ above-mentioned ]. In addition, in this example, since it is considering as the structure of combining revolution side case 3b and a wheel 2 using the above driving force transfer devices as well as the

above-mentioned best gestalten 2 and 3, the 2nd elastic member 13 arranged between revolution side case 3b and a wheel 2 is omissible.

[0037]

Next, arrangement of the direct-acting guides 19A and 19B is explained.

Direct-acting guide 19A consists of guide member 19a and guide-rail 19b, as shown in drawing 24 . In this example, on the periphery of plate (henceforth wheel side plate) 20A of hollow discoid located in a wheel 2 side, at intervals of 90 degrees While arranging four guides member 19a which has the crevice which carries out the direction extension of 45 degree to the direction of a path By arranging four guide-rails 19b which has the heights which engage with the location corresponding to each above-mentioned guide member 19a of plate (henceforth medium plate) 20B of hollow discoid located in the medium at each above-mentioned guide member 19a Wheel side plate 20A and medium plate 20B are connected through four direct-acting guide 19A mutually arranged at intervals of 90 degrees.

Moreover, direct-acting guide 19B consists of guide-rail 19c and 19d of guide members. On the periphery by the side of plate (henceforth motor side plate) 20C of hollow discoid located in the motor 3 side of the above-mentioned medium plate 20B, so that it may intersect perpendicularly with guide-rail 19b of the above-mentioned direct-acting guide 19A By arranging four guide-rails 19c at intervals of 90 degrees, and arranging 19d of four guide members in the location corresponding to each above-mentioned guide-rail 19c on the above-mentioned motor side plate 20C periphery Medium plate 20B and motor side plate 20C are connected through four direct-acting guide 19B mutually arranged at intervals of 90 degrees.

[0038]

In the above-mentioned configuration, the turning effort from revolution side case 3b of the in wheel motor 3 minds motor side plate 20C. Since orientation of each above-mentioned direct-acting guides 19A and 19B is carried out in the direction of 45 degree to the shaft orientations of the plates 20A-20C of hollow discoid in case it is transmitted to wheel side plate 20A combined with the wheel 2, As shown in drawing 25 , the force rotated to a hoop direction and the force extensible in the direction of a path act on above-mentioned medium plate 20B. however, on the background of each above-mentioned direct-acting guide 19B of the above-mentioned medium plate 20B (wheel 2 side), i.e., each above-mentioned direct-acting guide 19B and homotopic Since direct-acting guide 19A which works in the direction which intersects perpendicularly to each operation direction of each above-mentioned direct-acting guide 19B is arranged, the force which extends the above-mentioned medium plate 20B in the direction of a path It balances with the force extended in the direction of a path by each above-mentioned direct-acting guide 19A, only turning effort is transmitted to wheel side plate 20A as a result, and this turning effort is transmitted to a wheel 2. Therefore, since the above-mentioned medium plate 20B is transmitted to the turning effort inputted into direct-acting guide 19B from motor side plate 20C combined with revolution side case 3b by wheel side plate 20A by ****, the driving force of the above-mentioned motor 3 can be made to transmit to a wheel 2 certainly.

[0039]

In addition, since all the operation directions of each above-mentioned direct-acting guides 19A and 19B are the same, compression and tensile stress do not occur on the plates 20A-20C of each hollow discoid simultaneously, but only the force which extends or compresses the whole in the direction of a path acts on them. Moreover, since the operation direction of the above-mentioned direct-acting guide 19A and all the operation directions cross at right angles, compression and tensile stress do not generate each direct-acting guide 19B simultaneously, either. moreover, the force compressed [ which compresses and above-extends ] is **** about medium plate 20B -- since it is transmitted from the both sides of the guide rails 19b and 19c of both sides, there is no offset of a load in the hoop direction of medium plate 20B, and the risk of a buckling decreases.

[0040]

The best gestalt 5

Moreover, plate (wheel side plate) 20A of hollow discoid which replaces with the flexible coupling 18 of the above-mentioned best gestalt 3, is located in the wheel 2 side as shown in drawing 26 and drawing 27 , and is combined with a wheel 2, On each plate periphery by the side of hollow disc-like

plate (motor side plate) 20C and the motor 3 which are located in a motor 3 side and combined with revolution side case 3b of a motor 3, and a wheel 2, at intervals of 90 degrees or 180 degrees And two or more direct-acting guides 19P and 19Q are arranged in the table of a plate, and hidden homotopic, respectively. The 1st medium plate 20M of hollow discoid which was connected with the above-mentioned wheel side plate 20A by direct-acting guide 19P, and was connected with above-mentioned motor side plate 20C by direct-acting guide 19Q, It is arranged 1st inside [ this ] medium plate 20M, and two or more direct-acting guides 19R and 19S are arranged in medium plate 20M of the above 1st at a table and back reverse. Direct-acting guide 19R connects with the above-mentioned wheel side plate 20A. You may make it combine revolution side case 3b and a wheel 2 using the flexible coupling 20 which consists of 2nd medium plate 20N of hollow discoid connected with above-mentioned motor side plate 20C by direct-acting guide 19S. This becomes possible to reduce the oscillation in eccentric rotation of the above-mentioned plate, and the driving torque from the in wheel motor 3 to a wheel 2 can be transmitted certainly.
In addition, in this example, it has connected according to the direct-acting guide device 21 equipped with shock absorber 21b which consists of the spring member expanded and contracted like the above-mentioned best gestalt 4 in the operation direction of direct-acting guide member 21a which mentioned above nonrotation side case 3a and a knuckle 5, and which guides nonrotation side case 3a in the vertical direction of a vehicle, and this direct-acting guide member 21a, and an absorber.
[0041]
Next, arrangement of the above-mentioned direct-acting guides 19P and 19Q and the direct-acting guides 19R and 19S is explained.
Direct-acting guide 19P consist of guide member 19i and guide-rail 19j, as shown in drawing 27 . In this example, were prepared at intervals of 180 degrees on the periphery by the side of the 1st [ of wheel side plate 20A located in a wheel 2 side ] medium plate 20M. Two guide members 19i and 19i which have the crevice extended to the radial direction of medium plate 20M of the above 1st, The periphery top by the side of wheel side plate 20A of 1st medium plate 20M, It is prepared in the location corresponding to the above-mentioned guide members 19i and 19i, and is constituted by two guide rails 19j and 19j which have the heights which engage with the above-mentioned guide members 19i and 19i, and wheel side plate 20A and the 1st medium plate 20M are mutually guided in the direction of the diameter of a plate.
Direct-acting guide 19Q Moreover, the periphery top by the side of motor side plate 20C of 1st medium plate 20M, Two guide rails 19p and 19p prepared in the location rotated 90 degrees from the location of the above-mentioned guide rails 19j and 19j at intervals of 180 degrees, It is constituted by two guide members 19q and 19q prepared in the location corresponding to the above-mentioned guide rails 19p and 19p on the periphery of motor side plate 20C, and motor side plate 20C and the 1st medium plate 20M are mutually guided in the direction of the diameter of a disk.
On the other hand, direct-acting guide 19R on the periphery inside [ direction of diameter of wheel ] the above-mentioned guide members 19i and 19i Two guide members 19m and 19m which have the crevice which extends the above-mentioned guide members 19i and 19i to the radial direction of the above-mentioned wheel side plate 20A prepared in the direction rotated 90 degrees at intervals of 180 degrees, The periphery top by the side of medium plate 20N [ 2nd ] wheel side plate 20A, It is prepared in the location corresponding to the above-mentioned guide members 19m and 19m, and is constituted by two guide rails 19n and 19n which have the heights which engage with the above-mentioned guide members 19m and 19m. Two guide rails 19r and 19r with which direct-acting guide 19S were prepared in the location rotated 90 degrees from the above-mentioned guide rails [n / 19 / and 19n ] location on the periphery by the side of medium plate 20N [ 2nd ] motor side plate 20C at intervals of 180 degrees, It is prepared in the location corresponding to the above-mentioned guide rails 19r and 19r on the periphery of motor side plate 20C, and is constituted by two guide members 19s and 19s which have the crevice which engages with the above-mentioned guide rails 19r and 19r.
[0042]
A motor 3 rotates by the above-mentioned configuration, carrying out eccentricity to down to a wheel 2. Specifically, the force of a hoop direction in which motor torque was first inputted into motor side plate 20C, and it was inputted into this motor side plate 20C is inputted into 2nd medium

plate 20N through direct-acting guide 19S which work in the direction which intersects perpendicularly with the above-mentioned direct-acting guide 19Q while it is inputted into the 1st medium plate 20M through direct-acting guide 19Q.

The force of a hoop direction in which the force of a hoop direction in which it was inputted into medium plate 20M of the above 1st was inputted into wheel side plate 20A through direct-acting guide 19P, and it was inputted into medium plate 20N of the above 2nd is inputted into wheel side plate 20A through direct-acting guide 19R which works in the direction which intersects perpendicularly with the above-mentioned direct-acting guide 19P.

When rotating to the circumference of a clock while the motor 3 had carried out eccentricity to down to the wheel 2 as it follows, for example, is shown in drawing 28 (a) - (c), the 1st medium plate 20M which is outside rotates to the circumference of a clock, carrying out eccentricity a bottom -> left -> top a core [ the middle point between the shaft of wheel side plate 20A, and the shaft of wheel side plate 20A ]. On the other hand, it rotates to the circumference of a clock 2nd medium plate 20N which exists inside, carrying out eccentricity the bottom of top -> right -> a core [ the middle point between the shaft of wheel side plate 20A, and the shaft of motor side plate 20C ].

Here, if medium plate 20N [ of the above 2nd ] mass is made the same as the 1st mass of medium plate 20M, since the above 1st and the 2nd medium plate 20M and 20N rotate carrying out eccentricity in the direction of point symmetry as mentioned above, the oscillation by eccentricity is offset, eccentricity of motor side plate 20C and the wheel side plate 20A will be carried out only in the vertical direction, and they will not carry out eccentricity to a cross direction. Therefore, the oscillation in eccentric rotation of the plate (plates 20A, 20M, 20N, and 20C) of hollow discoid can be reduced, and driving force can be made to transmit to a wheel 2 certainly.

[0043]

moreover, it is shown in drawing 29 -- as -- the above-mentioned direct-acting guides 19P and 19Q -- and As [ turn into / to the direction of a path of Plates 20A, 20M, 20N, and 20C / each operation direction / replace with the direct-acting guides 19R and 19S, and / the direction of 45 degree ] If the direct-acting guides 22P and 22Q and a direct-acting guide, and 22R and 22S are attached in the homotopic of the above 1st and medium plate [ 2nd / 20M and 20N ] front flesh side While only the force in which compression and tensile stress do not occur simultaneously, but extend or compress the whole in the direction of a path acts on the plates 20A, 20M, 20N, and 20C of each above-mentioned hollow discoid like the above-mentioned best gestalt 4 Since the operation direction of the above-mentioned direct-acting guides 22P and 22R and all the operation directions cross at right angles, compression and tensile stress can be prevented from generating simultaneously each direct-acting guides 22Q and 22S. Therefore, there is no offset of a load in the above 1st and medium plate [ 2nd / 20M and 20N ] hoop direction, the risk of a buckling can decrease, and the endurance of a driving force transfer device can be raised.

In addition, direct-acting guide 22P and direct-acting guide 22Q As shown in drawing 29 , respectively Guide member 22a and guide-rail 22b, It consists of guide-rail 22c and 22d of guide members. Direct-acting guide 22R and direct-acting guide 22S Respectively, it consists of guide member 22e, guide-rail 22f, guide-rail 22g, and 22h of guide members, and guide member 22a and guide member 22e are arranged like the above-mentioned best gestalt 4 at wheel side plate 20A. Guide-rail 22b moreover, to the wheel side plate 20A side of 1st medium plate 20M Guide-rail 22c to the motor side plate 20C side of 1st medium plate 20M 22d of guide members and 22h of guide members are arranged by wheel side plate 20C guide-rail 22g guide-rail 22f at the motor side plate 20medium plate 20N [ 2nd ] C side at the wheel side plate 20medium plate 20N [ 2nd ] A side.

[0044]

The best gestalt 6

With the above-mentioned best gestalten 1-5, nonrotation side case 3a of the in wheel motor 3, and the knuckle 5 which are the axle part components of a vehicle The 1st elastic member 11 and direct-acting guide member 21a, Although the case where it joined together using buffer members, such as the direct-acting guide device 21 equipped with shock absorber 21b which consists of the spring member expanded and contracted in the operation direction of this direct-acting guide member 21a and an absorber, was explained As shown in drawing 30 , the tire touch-down fluctuation force can be further decreased by combining nonrotation side case 3a and a knuckle 5 according to the buffer

devices 23A and 23B which an end is connected with a knuckle 5 and support a motor 3 by the other end side.

In addition, although considered as the structure combined using the flexible coupling 18 which used revolution side case 3b and a wheel 2 with the above-mentioned best gestalt 3 in this example, it is good also as structure combined using the driving force transfer device of the flexible coupling 19 of the constant-velocity joint 16 shown in the above-mentioned best gestalt 2, or the above-mentioned best gestalten 4 and 5, and 20 grades.

What combined the above-mentioned two arms 23m and 23n of the link mechanism of the abbreviation A mold which consists of two arms 23m and 23n each other combined pivotable by end-point 23Z as the above-mentioned buffer devices 23A and 23B, for example, or an abbreviation H mold by buffer member 23k which consists of a spring or/and a damper can be used. In addition, although it fixes to 23s of mounting members in which the end side of buffer member 23k was attached by the above-mentioned arm 23m and the other end side was directly attached in the above-mentioned arm 23n in this example, you may make it attach the ends side of buffer member 23k in Arms 23m and 23n directly, respectively.

[0045]

As the above-mentioned buffer devices 23A and 23B, nonrotation side case 3a of the in wheel motor 3, and the joint approach of a knuckle 5, one arm 23m [ of the above-mentioned buffer devices 23A and 23B ] edge 23X is attached in nonrotation side case 3a of the above-mentioned motor 3, and anchoring and arm 23n [ of another side ] edge 23Y are attached in a knuckle 5. At this time, the above-mentioned buffer devices 23A and 23B are attached so that the flexible direction of the above-mentioned buffer member 23k may be in agreement with the vertical direction of a vehicle. Thereby, since the fluctuation direction of node 23Y of node 23X with above-mentioned arm 23m nonrotation side case 3a and the above-mentioned arm 23n knuckle 5 is limited in the flexible direction of buffer member 23k which consists of the above-mentioned spring or a damper, it becomes possible [ combining nonrotation side case 3a and a knuckle 5 in the vertical direction of a motor 3 rockable ].

That is, revolution side case 3b and the wheel 2 which fix Rota 3R of the in wheel motor 3 in this example are a flexible coupling 18 (). Or while being combined by flexible couplings 19 and 20 Since it is fixed to a hand of cut and elastic support of the nonrotation side case 3a which fixes stator 3S is carried out in the vertical direction to the knuckle 5 which are the axle part components of a vehicle While being able to raise the transmission efficiency of the torque from revolution side case 3b to a wheel 2, the tire touch-down fluctuation force can be decreased further, and the road-holding nature of a vehicle can be raised.

[0046]

The best gestalt 7

The buffer devices 23A and 23B which consist of the link mechanism of the abbreviation A mold which consists of two arms 23m and 23n combined by buffer member 23k with the above-mentioned best gestalt 6, or an abbreviation H mold are used. Although the case where nonrotation side case 3a of the in wheel motor 3 and the knuckle 5 which are the axle part components of a vehicle were combined was explained When the vehicle carrying the in wheel motor 3 is a vehicle equipped with the axle type suspension pen device As shown in drawing 31 , the tire touch-down fluctuation force can be decreased by combining nonrotation side case 3a and axle 9J according to the above-mentioned buffer devices 23A and 23B and the same buffer device 24 of a configuration.

As the above-mentioned buffer device 24, each can use what combined the above-mentioned two arms 24m and 24n of the link mechanism of the abbreviation H mold which consists of two arms 24m and 24n combined with axle 9J pivotable, or an abbreviation A mold by buffer member 24k which consists of a spring or a damper, for example. In addition, in this example, while combining two arms 24m and 24n of each other pivotable through axle 9J, the end considered as the configuration which connects two arms 24m and 24n through two buffer members 24k and 24k combined with axle 9J so that the flexible direction might be in agreement with the vertical direction of a vehicle. In addition, through 24s of mounting members, the above-mentioned buffer members 24k and 24k may be attached in Arms 24m and 24n, and may be directly attached in Arms 24m and 24n.

Thereby, also in the vehicle equipped with the axle type suspension device, since nonrotation side case 3a and a knuckle 5 are combinable in the vertical direction of a motor 3 rockable, the tire touch-down fluctuation force can be decreased further.
[0047]
The best gestalt 8
Drawing 32 is drawing showing the in wheel motor structure of a system concerning the gestalt 8 best [ this ]. The wheel to which a tire and 2 change from rim 2a and wheel-disc 2b in this drawing in 1, The hub section which set 3 on the in wheel motor of an outer rotor mold, set 4 to the above-mentioned wheel 2 and its revolving shaft, and was connected, The knuckle which are the axle part components of the vehicle with which 5 is connected with axle 9J, the suspension member to which 7 changes from a shock absorber etc., 8 showed the damping device with which the above-mentioned hub section 4 was equipped, and 18 to drawing 16 of the above-mentioned best gestalt 3 - drawing 18 . It has the plates 18A-18C of hollow discoid with which two or more direct-acting guides arranged so that a plate table flesh side and the actuation direction may cross at right angles were attached. Revolution side case 3b and the wheel 2 which support Rota 3R of the in wheel motor 3 The flexible coupling mutually combined with the radial direction of a wheel 2 possible [ eccentricity ] and 25 are the shock absorbers for supporting elastically nonrotation side case 3a which supports stator 3S of the in wheel motor 3 to vehicle up down ones to a knuckle 5. In addition, it may replace with the above-mentioned flexible coupling 18, and you may join together using the driving force transfer device of the flexible coupling 19 of the constant-velocity joint 16 which showed revolution side case 3b and a wheel 2 to the above-mentioned best gestalt 2, or the above-mentioned best gestalten 4 and 5, and 20 grades.
[0048]
As the above-mentioned shock absorber 25 is shown in drawing 33 , the actuation direction is mutually limited in the vertical direction of a vehicle through direct-acting guide 25a. It is the thing equipped with two plates 25A and 25B combined by spring 25b and damper 25c which operate in the vertical direction of a vehicle. And in this example The plate which is connected with axle 9J combined with the knuckle 5, and is located in the suspension member 7 side Four springs 25b expanded and contracted in the vertical direction of a vehicle is attached in four corners of 25B. (It is hereafter called a knuckle anchoring plate) Two damper 25c expanded and contracted in the vertical direction of a vehicle is attached in the both sides of 25m of communicating pores of axle 9J prepared in the center section. In the location corresponding to the upper part or the lower part of the above-mentioned spring 25b of plate (henceforth motor anchoring plate) 25A located in a motor 3 side, 25d of spring receptacle sections While attaching damper anchoring section 25e in the location corresponding to the upper part of the above-mentioned damper 25c, i.e., the upper part of the both sides of 25n of communicating pores of axle 9J The above-mentioned plates 25A and 25B are combined by four direct-acting guide 25a arranged to the core of a plate in the symmetric position. They can restrain the in wheel motor 3 in the vertical motion direction, the above-mentioned motor anchoring plate 25A and knuckle anchoring plate 25B generating damping force, since it is combined by spring 25b and damper 25c, while being guided by above-mentioned four direct-acting guide 25a vehicle up down one.
[0049]
Thus, with the gestalt 8 best [ this ], revolution side case 3b and the wheel 2 which fix Rota 3R of the in wheel motor 3 are combined by the flexible coupling 18. Nonrotation side case 3a which supports stator 3S is a wheel 2 (). Or since it is fixed to the hand of cut of axle 9J and was made to combine with vehicle up down one rockable While being able to raise the transmission efficiency of the torque from revolution side case 3b to a wheel 2, the tire touch-down fluctuation force can be decreased and the road-holding nature of a vehicle can be raised.
[0050]
The best gestalt 9
Although Plates 25A and 25B were combined with the above-mentioned best gestalt 8 by direct-acting guide 25a, spring 25b, and damper 25c As it replaces with the above-mentioned dampers 25c and 25c and is shown in drawing 34 and drawing 35 By using the shock absorber 30 equipped with the reservoir tank 29 connected with an oil hydraulic cylinder 26 and this oil hydraulic cylinder 26

with the proof-pressure hose 27 and 28 Since it can be made to combine with the vehicle upper and lower sides rockable while more certainly being able to fix nonrotation side case 3a which supports stator 3S to the hand of cut of a wheel 2 (or axle 9J), the tire touch-down fluctuation force can be decreased further.

Drawing 36 is drawing showing the detail of the shock absorber 30 equipped with the above-mentioned oil hydraulic cylinder. In this example Stroke side reservoir-tank 29A which opens the above-mentioned reservoir tank 29 for free passage to oil hydraulic cylinder 26 top room 26a separated by piston 26P to which the end side of piston rod 26L was fixed, While dividing into contraction side reservoir-tank 29B which is open for free passage to bottom room of oil hydraulic cylinder 26 26b and connecting above-mentioned oil hydraulic cylinder 26 top room 26a and stroke side reservoir-tank 29A through stroke side bulb (orifice) 27m He is trying to connect bottom room 26b and contraction side reservoir-tank 29B through contraction side bulb (orifice) 28m. In addition, 27n and 28n are the stroke side Tcheky valve for preventing the back run of 29s of hydraulic oil from a reservoir tank 29 to an oil hydraulic cylinder 26 prepared in the branching oil passage 27k and 28k which bypasses each (the above-mentioned stroke side bulb 27m and contraction side bulb 28m), respectively, and a contraction side Tcheky valve.

In addition, to knuckle anchoring plate 25B connected with the knuckle 5 which are axle part components, he arranges only the simple oil hydraulic cylinder 26 of structure, and is trying to equip locations other than axle part (car-body side which axle 9J do not illustrate here) with the reservoir tank 29 which guarantees the flow rate of 29s of hydraulic oil made to generate damping force in this example, as shown in drawing 35 .

[0051]

In the shock absorber 30 of this example, since it is considering as the structure which connected piston top room 26a of an oil hydraulic cylinder 26, and bottom room 26b to the independent bulbs 27m and 28m and reservoir tanks 29A and 29B with the proof-pressure hose 27 and 28, respectively, it has the advantage that the damping force of the stroke side of a shock absorber 30 and the damping force by the side of a contraction can be adjusted separately.

As shown in drawing 37 , moreover, piston top room 26a of an oil hydraulic cylinder 26, and bottom room 26b After connecting by the independent bulbs 27m and 28m, respectively, as it considers both passage as the configuration linked to common reservoir-tank 29C or it is shown in drawing 38 If it considers as the configuration which connects bottom room of piston 26b, and reservoir-tank 29C after connecting piston top room 26a of an oil hydraulic cylinder 26, and bottom room 26b by the independent bulbs 27m and 28m, respectively While being able to reduce the components mark of a shock absorber 30, a shock absorber 30 can be miniaturized.

[0052]

The best gestalt 10

Drawing 39 is drawing showing the in wheel motor structure of a system concerning the gestalt 10 best [ this ], and drawing 40 is the important section sectional view. The wheel to which a tire and 2 change from rim 2a and wheel-disc 2b in each drawing in 1, and stator 3S which were fixed to nonrotation side case 3a which 3I received radially and was prepared outside, It is the inner rotor mold motor (in wheel motor) of the hollow configuration equipped with Rota 3R fixed to revolution side case 3b which received radially, was prepared inside and joined pivotable to the above-mentioned nonrotation side case 3a through bearing 3j.

The hub section with which 4 was connected in the above-mentioned wheel 2 and its revolving shaft, the knuckle by which 5 is connected with the up-and-down suspension arms 6a and 6b, the suspension member to which 7 changes from a shock absorber etc., and 8 are damping devices which consist of the brake disc equipped with brake rotor 8a with which the above-mentioned hub section 4 was equipped, and brake caliper 8b.

Direct-acting guide member 21a which shows nonrotation side case 3a which is the outside case of the above-mentioned in wheel motor 3I, and the knuckle 5 which are the axle part components of a vehicle in the vertical direction of a vehicle to the above-mentioned nonrotation side case 3a in this example, While joining together using the direct-acting guide device 21 equipped with shock absorber 21b which consists of the spring member expanded and contracted in the operation direction of this direct-acting guide member 21a, and an absorber Revolution side case 3b and the

wheel 2 which are the inside case of the above-mentioned motor 3 It joins together using the flexible coupling 18 which consists of the plates 18A-18C of hollow discoid with which two or more direct-acting guides 18p and 18q which were shown in <u>drawing 16</u> of the above-mentioned best gestalt 3 - <u>drawing 18</u> , and which have been arranged so that the front flesh side of a plate and the actuation direction may cross at right angles were attached. The revolution side case 3b and wheel 2 of each other which support Rota 3R of the in wheel motor 3 are combined with the radial direction of a wheel 2 possible [ eccentricity ] by the above-mentioned flexible coupling 18.

In addition, the direct-acting guide device 21 should just attach the upper bed section of the above-mentioned direct-acting guide device 21 in which fixed the intercept to the side face of an opposite hand in the wheel 2 of nonrotation side case 3a, and the end was fixed for while a cross-section configuration is 21t of connection members of a L character mold by the intercept of another side at the knuckle 5.

[0053]

Direct-acting guide member 21a which guides the above-mentioned nonrotation side case 3a in the vertical direction of a vehicle as mentioned above with the gestalt 10 best [ this ], It attaches in a knuckle 5 using the direct-acting guide device 21 equipped with shock absorber 21b which consists of the spring member expanded and contracted in the operation direction of this direct-acting guide member 21a, and an absorber. Since it constituted so that floating mounting of the in wheel motor 3 could be carried out to a part for the spring lower part which are the axle part components of a vehicle, a motor shaft and an axis arm become independently rockable in the direction of a path. For this reason, motor mass is separated from an equivalent for the nonsuspended mass of a vehicle, and acts as the so-called weight of a tuned damper.

Since the road-holding nature of a vehicle not only improves, but fluctuation of the tire touch-down force is reduced and the weight of a tuned damper can decrease the oscillating input to the motor 3 at the time of bad road transit in order that it may negate the oscillation at the time of concavo-convex way transit under a spring, it can reduce the oscillating load of a motor 3.

Moreover, although the in wheel motor 3 can be moved as radial direction ** of the actuation direction 18A-18C of the direct-acting guides 18p and 18q of a flexible coupling 18, i.e., the plates of hollow discoid, since revolution side case 3b of the in wheel motor 3 and a wheel 2 were connected using the flexible coupling 18, it cannot move to a hand of cut by limit of the above-mentioned direct-acting guides 18p and 18q. Therefore, the running torque from Rota 3R can be efficiently transmitted to a wheel 2.

Moreover, by using the above-mentioned flexible coupling 18, although a motor vibrates at the time of bad road transit and a motor shaft and an axis arm carry out eccentricity, even if it carries out eccentricity, a revolution can be transmitted smoothly.

[0054]

In addition, it becomes possible to raise an actuation transmission efficiency further by replacing with the above-mentioned flexible coupling 18, and using the driving force transfer device of a flexible coupling 19 and 20 grades shown in a gestalt 4 or the best gestalt 5 best [ above-mentioned ].

Moreover, also in the in wheel motor system of this invention, in order that the hub section 4 may support vehicle mass, its load load to motor 3 body is small. Therefore, since air gap change between Rota 3R and stator 3S can be made small, case rigidity can be lowered and a motor 3 can be lightweight-ized.

In addition, when an outer rotor mold motor is used for this invention, an outer-race side will rotate, in case a motor carries out a high-speed revolution, an outer race is expanded to the direction outside of a path according to the centrifugal force, backlash arises to a bearing, and the bearing of the revolution section is not desirable in endurance.

Therefore, since an inner race rotates a bearing by using the inner rotor mold motor which the inside rotates like this example and an inner race is expanded in the direction of a path at the time of a high-speed revolution, the backlash of a bearing is not generated. Moreover, since the radius of a rotating part is small compared with an outer rotor mold, an inner rotor mold can make moment of inertia small, and since the responsibility over accelerator actuation can also be raised, it becomes possible [ realizing the in wheel motor vehicle excellent in the transit stability of a vehicle ].

[Example 1]

[0055]

It analyzes with the vehicle oscillating model at the time of concavo-convex way transit as shows the vibration level in the in wheel motor system by the configuration of the gestalt 1 best [ this ] in the table of the following drawing 41 - drawing 43 , and drawing 44 , and the result compared with the fluctuation level of the touch-down force in the conventional system is shown in the graph of drawing 45 .

In addition, in drawing 45 , an axis of abscissa is an excitation frequency (Hz), and an axis of ordinate is the fluctuation level (N) of the tire touch-down force. Moreover, the example 1-1 of a comparison is a vehicle oscillating model in case the in wheel motor is not carried.

Since it is directly equipped with an in wheel motor to nonsuspended mass equivalent parts, such as a wheel and a knuckle, the vehicle oscillating model is expressed in the conventional system by the oscillating model of two degrees of freedom as shown in drawing 41 (example 1-2 of a comparison). In the oscillating model by which nonsuspended mass m1 was combined with the ground plane, the elastic body k1, and dash pot c1 of a tire, and the above-mentioned nonsuspended mass m1 and sprung mass m2 were combined with the detail with the elastic body k2 and the dash pot c2, it becomes the model with which the mass of an in wheel motor is added to the above-mentioned nonsuspended mass m1. Thus, when directly equipped with a motor, since nonsuspended mass increases, the fluctuation level of the tire touch-down force increases. Since a tire has the nonlinearity over a touch-down load as shown in drawing 46 , if its fluctuation of the touch-down force is large, capacity, such as Tire CP (cornering power), will decline and road-holding nature will fall. In order to maintain this on the level of the above-mentioned example 1-1 of a comparison, it is necessary to make AUW of a motor and axle part components the same. However, since the serious cost rise of using a light alloy etc. abundantly etc. is expected in order to lightweight-ize axle part components substantially, satisfying the reinforcement demanded, it cannot be said that it is practical.

[0056]

There is an approach called a tuned damper as an approach of on the other hand reducing the load fluctuation level at the time of concavo-convex way transit, without carrying out lightweight-ization. This tuned damper can reduce the fluctuation level of the tire touch-down force, without 3 degree-of-freedom model (example 1-3 of a comparison) to which the new mass m3 was added being able to express through an elastic body k3 and a dash pot c3 to 2 degree-of-freedom model shown in above-mentioned drawing 41 , and taking the measures against lightweight-ized according to this approach, as shown in drawing 42 . However, in the above-mentioned tuned damper, the fluctuation reduction effectiveness improves so that weight is increased, but since this additional weight has adverse effects, such as an increase of car weight, for a vehicle and the above-mentioned weight can seldom be increased, there is a limitation in the fluctuation reduction effectiveness.

[0057]

On the other hand, in the in wheel motor system of this invention, since the in wheel motor is combined with axle part components (spring lower part) through the elastic body or the elastic body, and the guide device as shown in drawing 1 , drawing 7 , or drawing 39 , as a vehicle oscillating model, the weight of a tuned damper as shown in drawing 43 can express with 3 degree-of-freedom model equivalent to the mass m3 of the above-mentioned in wheel motor (example 1-1).

Therefore, fluctuation level can be reduced, without increasing car weight in an excess, as shown in the graph of drawing 45 .

at this time , the fluctuation level of a tire touch-down force can be certainly reduce by adjust the elastic coefficient k3 of the elastic body which combine the mass m3 and the spring lower part of an in wheel motor so that it may become low than the resonance frequency f1 of the spring lower part highly than the resonance frequency f2 of the spring upper part about the resonance frequency f3 of the in wheel motor attached the account of a top , as show in the following formula .

[Equation 1]

$$f_2 < f_3 < f_1$$

$$f_1 = \frac{1}{2\pi}\sqrt{\frac{m_1}{k_1}} \qquad f_2 = \frac{1}{2\pi}\sqrt{\frac{m_2}{k_2}} \qquad f_3 = \frac{1}{2\pi}\sqrt{\frac{m_3}{k_3}}$$

Moreover, in the above-mentioned configuration, when lightweight-ize a motor and axle part components, the elastic coefficient of an elastic body is made small like an example 1-3 or both are further combined like an example 1-4 like an example 1-2, fluctuation level can be reduced further (see the table of drawing 44 , and the graph of drawing 46 ).
[0058]
The best gestalt 11
Drawing 47 is drawing showing the in wheel motor structure of a system concerning the gestalt 11 best [ this ]. The wheel to which a tire and 2 change from rim 2a and wheel-disc 2b in this drawing in 1, and stator 3S by which 3 was fixed to nonrotation side case 3a, It is the in wheel motor of the outer rotor mold equipped with Rota 3R fixed to revolution side case 3b which received radially, was prepared outside and joined pivotable to the above-mentioned nonrotation side case 3a through bearing 3j.
Moreover, as for the knuckle which are the axle part components of a vehicle with which the hub section with which 4 was connected in a wheel 2 and its revolving shaft, and 5 were connected with suspension arms 6a and 6b, and 7, a suspension member and 8 are damping devices.
With the gestalt 11 best [ this ], nonrotation side case 3a of the in wheel motor 3 While combining revolution side case 3b which combined with the knuckle 5 which are the axle part components of a vehicle, and was combined pivotable through the above-mentioned nonrotation side case 3a and bearing 3j so that it may be inscribed in the wheel 2 to rotate By constituting so that the hub section 4 connected in the above-mentioned wheel 2 and its revolving shaft and a knuckle 5 may be joined by the hub bearing 31 in which it was prepared inside the in wheel motor 3 of the above-mentioned hollow configuration It made it possible to distribute vehicle weight to motor case 3C constituted by a wheel 2, and above-mentioned nonrotation side case 3a, bearing 3j and revolution side case 3b.
That is, since vehicle weight is the ratio of "wheel rigidity including the rigidity of a hub bearing", and the "rigidity of a motor case" and it is distributed to a wheel 2 and motor case 3C by taking the above-mentioned structure, the vehicle weight for every wheel is shared not only with motor case 3C but with the hub bearing 31. Since change of air gap 3g which the load load to motor case 3C was reduced, and was formed between Rota 3R and stator 3S by this can be made small, the rigidity of motor case 3C can be lowered, or the motor itself can be miniaturized, and the in wheel motor 3 can be lightweight-ized. Therefore, under the spring of a vehicle, since a spring top vibration level can be reduced, the degree-of-comfort nature of a vehicle can be raised.
[0059]
Moreover, in this example, since he is trying to equip the hub section 4 with a damping device 8 while being able to transmit torque to a wheel 2 from the in wheel motor 3, since it has join together so that revolution side case 3b which is an outside case may be inscribe in a wheel 2, at the time of braking, damping torque transmits only to the above-mentioned hub section 4 and a knuckle 5, and braking reaction force does not act on motor case 3C. Therefore, since rigidity of motor case 3C can be made small, the in wheel motor 3 can be lightweight-ized further.
At this time, as shown in drawing 48 , distortion of motor case 3C can be further reduced by combining revolution side case 3b with a wheel 2 through an elastic member 32.
That is, since it rotates in the condition of having been distorted in response to the stress of various directions from the road surface etc., a wheel 2 can reduce distortion of motor case 3C by absorbing deformation of this wheel 2 by the above-mentioned elastic member 32. Therefore, rigidity of motor case 3C can be made still smaller, and the in wheel motor 3 can be lightweight-ized. Moreover, in the above-mentioned configuration, since it is combined by the elastic member 32, revolution side

case 3b and a wheel 2 can transmit torque to a wheel 2 from the in wheel motor 3, even if the wheel 2 is distorted.
[0060]
As the above-mentioned elastic member 32, when spring materials, such as rubber, are used, as an ingredient which constitutes the above-mentioned elastic member 32, it is desirable to use the ingredient whose modulus of direct elasticity is 1MPa-120MPa. Moreover, it is still more desirable if the above-mentioned modulus of direct elasticity is 1MPa-40MPa.
In addition, like the usual automobile, as shown in drawing 49 , if connection section 4D with a drive shaft 9 is prepared, the power from the power engine or motor of mount of those other than in wheel motor 3 can be transmitted to a wheel 2 through a drive shaft 9 at the hub section 4. It becomes yes, possible by following, for example, connecting the output shaft of a gasoline engine vehicle to the hub section 4 of the in wheel motor system of this example to consider as a Brit car.
[0061]
The best gestalt 12
Drawing 50 is drawing showing the in wheel motor structure of a system concerning the gestalt 12 best [ this ]. The wheel to which a tire and 2 change from rim 2a and wheel-disc 2b in this drawing in 1, and stator 3S which were fixed to nonrotation side case 3a which 3 received radially and was prepared inside, It is the in wheel motor of the outer rotor mold equipped with Rota 3R fixed to revolution side case 3b which received radially, was prepared outside and joined pivotable to the above-mentioned nonrotation side case 3a through bearing 3j.
The knuckle which are the axle part components of a vehicle with which the hub section with which 4 was connected in a wheel 2 and its revolving shaft, and 5 were connected with the up-and-down suspension arms 6a and 6b, respectively, the suspension member to which 7 changes from a shock absorber etc., and 8 are damping devices which consist of the brake disc with which the above-mentioned hub section 4 was equipped.
Moreover, the shock absorber only for motors for 33 to attach the above-mentioned in wheel motor 3 in a car-body 100 side, The flexible coupling which is the driving force transfer device of the configuration as the in wheel motor 3 and the above-mentioned best gestalt 4 established between wheels 2 with 34 [ same ], 35 is the direct-acting guide device of the same configuration as the above-mentioned nonrotation side case 3a and the above-mentioned best gestalt 4 established between knuckles 5. In this direct-acting guide device 35 The spring member 36 for the collision prevention for preventing the collision with the wheel 2 and the in wheel motor 3 which were not directly connected with above-mentioned nonrotation side case 3a, but were connected only with the knuckle 5 is formed.
[0062]
The shock absorber 33 only for [ above-mentioned ] motors consists of damper 33b which consists of the elastic body or spring member which combines arm 33a for motors extended to a car-body 100 side, and this arm 33a for motors and car body 100, and supports nonrotation side case 3a of the in wheel motor 3 by the above-mentioned arm 33a for motors connected with the car-body 100 side through this damper 33b. Therefore, while being unable to vibrate in a hand of cut, but being able to vibrate the in wheel motor 3 only in the vertical direction to a car body 100 and a wheel 2 and being able to transmit running torque efficiently by the flexible coupling 34, it becomes possible by attaching the above-mentioned motor 3 in a car-body 100 side using the shock absorber 33 only for [ above-mentioned ] motors to consider as a configuration which carries the in wheel motor 3 in a part for the spring upper part.
[0063]
In the in wheel motor system of the gestalt 12 best [ this ], since he is trying to attach nonrotation side case 3a of the in wheel motor 3 in a car-body 100 side through the shock absorber 33 only for motors, the in wheel motor 3 will be carried in a part for the spring upper part, and nonsuspended mass can be reduced. Therefore, tire touch-down force fluctuation can be reduced and the transit stability of a vehicle can be raised.
Moreover, in this example, since the spring member 36 for collision prevention prepared between the wheel 2 and the in wheel motor 3 carries out the role of the bump rubber which prevents that a wheel 2 and the in wheel motor 3 collide, even when a suspension strokes greatly with the roll of a car

body etc., a wheel 2 and the in wheel motor 3 can prevent colliding directly. In addition, even if it forms the spring member 36 for the above-mentioned collision prevention between revolution side case 3b and a wheel 2, it can acquire the same effectiveness. Moreover, the spring member 36 for the above-mentioned collision prevention may be formed in both between case-knuckles or between a wheel-motor, and between case-knuckles.

[0064]

In addition, as shown in drawing 51 , fluctuation of the tire touch-down force can be further reduced by connecting between nonrotation side case 3a of the in wheel motor 3, and knuckles 5 by the buffer member 37 which consists of a spring member in addition to the above-mentioned direct-acting guide device 35 and the spring member 36 for collision prevention. That is, the mass of the in wheel motor 3 acts as the so-called weight of a tuned damper to nonsuspended mass by connecting the in wheel motor 3 with the knuckle 5 which is the nonsuspended mass equivalent part of a vehicle through the buffer member 37. Therefore, fluctuation of the tire touch-down force at the time of concavo-convex way transit of a vehicle can be reduced further, and the road-holding nature of a vehicle can be raised. Moreover, since the mass of the in wheel motor 3 is separated from the nonsuspended mass equivalent part of a vehicle by the above-mentioned configuration, a direct oscillation is not transmitted to the above-mentioned in wheel motor 3 at the time of bad road transit, but the oscillating load to the in wheel motor 3 is also reduced by it.

[Example 2]

[0065]

The result of having analyzed the fluctuation level of the touch-down force in the in wheel motor system by the gestalt 12 best [ this ] and the conventional system with the following drawing 52 - drawing 54 , and the vehicle oscillating model at the time of concavo-convex way transit as shows in the table of drawing 55 is shown in the graph of drawing 56 . In addition, the example 2-1 of a comparison is an example of the electric vehicle which has not adopted the usual in wheel motor system, and since a motor is carried in a car-body side, motor mass is equivalent to sprung mass here.

In addition, in drawing 56 , an axis of abscissa is a road surface input frequency (Hz), and an axis of ordinate is the fluctuation level (N) of the tire touch-down force.

For example, since a motor is attached in a wheel, a knuckle, etc. and motor mass is equivalent to sprung mass, as a vehicle oscillating model, it is expressed in the conventional in wheel motor system as shown in above-mentioned drawing 79 by the oscillating-under spring model of two degrees of freedom as shown in drawing 52 (example 2-2 of a comparison). In the oscillating model by which nonsuspended mass m1 was combined with the ground plane, the elastic body k1, and dash pot c1 of a tire, and the above-mentioned nonsuspended mass m1 and sprung mass m2 were combined with the detail with the elastic body k2 and the dash pot c2, it becomes the model with which the mass of an in wheel motor is added to the above-mentioned nonsuspended mass m1. Thus, when directly equipped with a motor, since nonsuspended mass increases, tire touch-down force fluctuation level increases, and tire capacity declines ( drawing 56 ).

In order to maintain this tire touch-down force fluctuation level on the level of the above-mentioned example 2-1 of a comparison, as shown in the example 2-3 of a comparison, it is necessary to make AUW of a motor and axle part components the same. However, since the serious cost rise of using a light alloy etc. abundantly etc. is expected in order to lightweight-ize axle part components substantially, satisfying the reinforcement demanded, it cannot be said that it is practical.

[0066]

On the other hand, it sets to the in wheel motor system of this invention. As shown in drawing 50 , while attaching an in wheel motor in a car-body side through the shock absorber equivalent to an elastic body k3 and a dash pot c3 Since it is considering as the configuration attached in a car-body 100 side through the shock absorber only for motors, as a vehicle oscillating model As shown in drawing 53 , 3 degree-of-freedom model (example 2-1) which combined the mass m3 of a motor with sprung mass m2 through the elastic body k3 and the dash pot c3 can express to 2 degree-of-freedom model shown in above-mentioned drawing 52 .

Therefore, as shown in the graph of drawing 56 , it can be made the electric vehicle and equivalent level which showed touch-down force fluctuation level to the above-mentioned example 2-1 of a

comparison and which have not adopted the usual in wheel motor system.

Moreover, as shown in drawing 51 , while attaching an in wheel motor in a car-body side through the above-mentioned shock absorber When it considers as the structure which added the buffer member which consists of an elastic body k4 and a dash pot c4 between an in wheel motor and axle part components While the mass m3 of a motor as shown in drawing 54 makes it combine with sprung mass m2 with an elastic body k3 and a dash pot c3 as a vehicle oscillating model The model combined so that the mass m3 of the above-mentioned motor might serve as weight of a tuned damper to nonsuspended mass m1 can express (example 2-2).

Therefore, the touch-down force fluctuation level of 10Hz or more can be reduced, without increasing car weight in an excess, as shown in the graph of drawing 56 .

Moreover, the touch-down force fluctuation level of 10 moreHz or more can be reduced by weakening the spring force k3 between an in wheel motor and a car body, and strengthening the spring force k4 between a motor and axle part components like an example 2-3.

[0067]

The best gestalt 13

with the above-mentioned best gestalten 1-12 , although the usual in wheel motor 3 be explained , while being able to reduce tire touch-down force fluctuation and being able to raise road-holding nature by attach the above-mentioned motor in the vehicle spring lower part through a buffer member or a shock absorber also about the geared motor which combined the inner rotor mold motor and reduction gear of a hollow configuration , it become possible to make turning effort transmit to a wheel certainly .

Drawing 57 is drawing showing the in wheel motor structure of a system concerning the gestalt 13 best [ this ], and drawing 58 is the important section sectional view. The wheel to which a tire and 2 change from rim 2a and wheel-disc 2b in each drawing in 1, The geared motor with which 40 built the electric motor 41 and the planet reducer 42 into the motor case 43 at one (in wheel motor), The hub section with which 4 was connected in a wheel 2 and its revolving shaft, and 5 were connected with the up-and-down suspension arms 6a and 6b, respectively. The knuckle which are the axle part components of a vehicle, the suspension member to which 7 changes from a shock absorber etc., and 8 are damping devices which consist of the brake disc with which the above-mentioned hub section 4 was equipped.

Moreover, an elastic body for 44 to connect the motor case 43 and knuckle 5 which are the nonrotation section of a geared motor 40, and 45 are shafts which connect the output shaft and wheel 2 of the planet reducer 42 and which have universal-joint 45j.

[0068]

Stator 41S fixed to nonrotation side case 41a which the electric motor 41 of a geared motor 40 received radially, and was prepared outside, By the inner rotor mold motor of the hollow configuration equipped with Rota 41R fixed to revolution side case 41b which received radially, was prepared inside and joined pivotable to the above-mentioned nonrotation side case 41a through bearing 41j The above-mentioned nonrotation side case 41a is attached in the motor case 43 combined with the knuckle 5 which is a fixed part through the elastic body 44. Revolution side case 41b While 41d of connection members connects with sun gear 42a of the planet reducer 42, it is attached in wall 43a which constitutes the shank of the shape of hollow of the motor case 43 pivotable through bearing 43b. In the above-mentioned planet reducer 42, the rotational speed of the above-mentioned sun gear 42a is changed into the rate equivalent to the cycle of revolution round the sun of planetary-gear 42b, is slowed down, and is transmitted to a wheel 2 through the above-mentioned shaft 45 connected with the output shaft of the planet reducer 42 from carrier 42c.

While arranging four elastic bodies 44 to the symmetry on the disc-like motor mounting member 46 in this example as shown in drawing 59 in case the motor case 43 and a knuckle 5 are combined through an elastic body 44 He is trying to limit the splash direction of a motor in the vertical direction to a wheel by joining together between the above-mentioned elastic body 44 and 44 using the motor mounting device 47 in which direct-acting guide 47k which guides the motor case 43 in the vertical direction was prepared, respectively.

[0069]

Since the above-mentioned geared motor 40 was constituted from this example by attaching in a

knuckle 5 the motor case 43 which is the nonrotation section of a geared motor 40 as mentioned above using an elastic body 44 so that floating mounting could be carried out to a part for the spring lower part which are the axle part components of a vehicle, a motor shaft and an axis arm become independently rockable in the direction of a path. For this reason, since motor mass is separated from an equivalent for the nonsuspended mass of a vehicle and it acts as the so-called weight of a tuned damper like the case of the above-mentioned best gestalten 1-12, the oscillation at the time of concavo-convex way transit under a spring is negated, and fluctuation of the tire touch-down force is reduced. Therefore, the road-holding nature of a vehicle not only improves, but since the oscillating input to the geared motor 40 at the time of bad road transit can be decreased, it can reduce the oscillating load of the above-mentioned motor 40.

Moreover, since it joined together according to the motor mounting device 47 equipped with direct-acting guide 47k which shows the motor case 43 and a knuckle 5 in the vertical direction to an elastic body 44 and the motor case 43, a geared motor 40 can be moved along the vertical direction of a vehicle, but since it cannot move to a hand of cut by limit of direct-acting guide 47k, the surroundings stop of the motor case 43 which is the nonrotation section can be performed. Moreover, by using the above-mentioned universal-joint 45j, although a motor vibrates at the time of bad road transit and a motor shaft and an axis arm carry out eccentricity, even if it carries out eccentricity, a revolution of a motor can be transmitted smoothly.

[0070]

Moreover, in the in wheel motor system of the gestalt 13 best [ this ], in order that the hub section 4 may support vehicle mass, its load load to motor 40 body is small. Therefore, since air gap change between Rota 41R and stator 41S can be made small, case rigidity can be lowered and a motor 40 can be lightweight-ized.

Moreover, since a geared motor 40 is connected with the hub section 4 by the shaft 45 which has universal-joint 45j passing through the core, even if a geared motor 40 rocks relatively to an axle part part, turning effort can be certainly transmitted to a wheel 2.

Moreover, in this example, since motor weight can also be reduced while being able to make capacity of a motor small generating the same torque as compared with the case where an outer rotor mold direct drive motor is used, since the geared motor 40 is used as an in wheel motor, it becomes mitigable [ reduction of vehicle AUW, or a motor manufacturing cost ]. Furthermore, since a geared motor 40 can choose gear ratio and it can set up a torque curve freely by the same motor, its versatility improves compared with an outer rotor mold direct drive.

[Example 3]

[0071]

The result analyzed with the vehicle oscillating model at the time of concavo-convex way transit as shows the fluctuation level of the touch-down force in the in wheel motor system by the above-mentioned best gestalt 13 and the conventional system in the table of the following drawing 60 - drawing 62 , and drawing 63 is shown in the graph of drawing 64 .

In addition, the example 3-1 of a comparison is an example of the electric vehicle which has not adopted the usual in wheel motor system, and since a motor is carried in a car-body side, motor mass is equivalent to sprung mass here.

Since equivalents for nonsuspended mass, such as a wheel and a knuckle, are equipped with a motor, as a vehicle oscillating model, it is expressed in the conventional in wheel motor system by the oscillating-under spring model of two degrees of freedom as shown in drawing 60 (example 3-2 of a comparison of the table of drawing 63 ). In the oscillating model by which nonsuspended mass m1 was combined with the ground plane, the elastic body k1, and dash pot c1 of a tire, and the above-mentioned nonsuspended mass m1 and sprung mass m2 were combined with the detail with the elastic body k2 and the dash pot c2, it becomes the model with which the mass of an in wheel motor is added to the above-mentioned nonsuspended mass m1. Thus, since nonsuspended mass increases when it equips with a motor directly to a nonsuspended mass equivalent part, as shown in drawing 64 , tire touch-down force fluctuation level increases, and road-holding nature gets worse.

[0072]

In order to maintain this tire touch-down force fluctuation level on the level of the above-mentioned example 3-1 of a comparison, it is necessary to make AUW of a motor and axle part components the

same. However, since the serious cost rise of using a light alloy etc. abundantly etc. is expected in order to lightweight-ize axle part components substantially, satisfying the reinforcement demanded, it cannot be said that it is practical.
There is an approach called the tuned damper expressed with a model as shown in drawing 61 as an approach of on the other hand reducing fluctuation of the tire touch-down force at the time of concavo-convex way transit, without carrying out especially lightweight-ization (example 3-3 of a comparison of the table of drawing 63 ). 3 degree-of-freedom model to which the new weight m3 was added through the elastic body k3 and the dash pot c3 can express this to the nonsuspended mass m1 of 2 degree-of-freedom model of above-mentioned drawing 60 , and as shown in drawing 64 , it has the effectiveness of reducing fluctuation of the tire touch-down force.
By this approach, it was effective so that the additional weight m3 was increased, but since this additional way m3 TO made vehicle weight only increase in addition to the above-mentioned fluctuation reduction, since it became an adverse effect, there was a limitation in the increment in the above-mentioned weight m3 for a vehicle.
[0073]
On the other hand, in the in wheel motor system of this invention, since it is considering as the configuration which attaches the in wheel motor (geared motor) 40 in a car-body side through an elastic body 44 as shown in drawing 57 , as shown in drawing 62 , as a vehicle oscillating model, 3 degree-of-freedom model (example 3-1) which combined motor mass with nonsuspended mass m1 through the elastic body k3 and the dash pot c3 can express. In above-mentioned drawing 61 , this removes the motor mass added to nonsuspended mass m1, and is taken as the additional weight m3 which uses this motor mass for a tuned damper. Therefore, it can be made the electric vehicle and equivalent level which showed touch-down force fluctuation level to the above-mentioned example 3-1 of a comparison and which have not adopted the usual in wheel motor system, without increasing car weight in an excess, as shown in the graph of drawing 64 .
Moreover, when both a motor and axle part components were lightweight-ized to the above-mentioned example 3-1 (example 3-2), or when both are combined when the elastic modulus of an elastic body is made small (example 3-3) (example 3-4), the fluctuation level of the tire touch-down force can be reduced further.
[0074]
The best gestalt 14
Drawing 65 is drawing showing the in wheel motor structure of a system concerning the gestalt 14 best [ this ]. The wheel to which a tire and 2 change from rim 2a and wheel-disc 2b in this drawing in 1, and stator 3S which were fixed to nonrotation side case 3a which 3 received radially and was prepared inside, It is the in wheel motor of the outer rotor mold equipped with Rota 3R fixed to revolution side case 3b which received radially, was prepared outside and joined pivotable to the above-mentioned nonrotation side case 3a through bearing 3j.
The knuckle which are the axle part components of a vehicle with which the hub section with which 4 was connected in a wheel 2 and its revolving shaft, and 5 were connected with the up-and-down suspension arms 6a and 6b, respectively, the suspension member to which 7 changes from a shock absorber etc., and 8 are damping devices which consist of the brake disc with which the above-mentioned hub section 4 was equipped.
In this example, revolution side case 3b of the above-mentioned in wheel motor 3 and a wheel 2 are combined by the flexible coupling 51. As the above-mentioned flexible coupling 51, the thing of the same configuration as the flexible couplings 18, 19, and 20 shown in drawing 26 of the best drawing 23 [ of the above-mentioned best gestalt 4 ] - drawing 25 , and above-mentioned gestalt 5 - drawing 28 or drawing 32 of the above-mentioned best gestalt 8, drawing 33 , etc. can be used, for example.
[0075]
On the other hand, nonrotation side case 3a is attached in the periphery section of the disc-like motor mounting member 52 by which notching section 52S were formed in the center, as shown also in drawing 66 . This motor mounting member 52 is combined with the hollow ellipse board-like motor vertical supporter material 55 which has a major axis in a cross direction through the damper 53 which consists of the spring member with which slide guide 53G to which it shows vehicle up down one were equipped, and the direct-acting guide 54 to which it shows vehicle up down one.

Furthermore, this motor vertical supporter material 55 is attached in the knuckle 5 which is a fixed part through the elastic body 56, the direct-acting guide 57 to which it shows a vehicle cross direction, and the knuckle mounting member 58 of hollow discoid. in addition, the damper 53 and the direct-acting guide 54 which combine between the above-mentioned motor mounting member 52 and the motor vertical supporter material 55 in this example, and the elastic body 56 and the direct-acting guide 57 which combine between the above-mentioned motor vertical supporter material 55 and the knuckle mounting members 58 -- alternation -- and it has arranged to four symmetry at each circumferencial direction.

[0076]

Thereby, while supporting the in wheel motor 3 through a direct-acting guide and an elastic body to vehicle up down one, the knuckle which are the vertical direction supporter article and axle part components can be supported through a direct-acting guide and an elastic body to a vehicle cross direction.

Namely, since it was made to join together through the damper 53 and the direct-acting guide 54 which show nonrotation side case 3a of the in wheel motor 3 to the hollow ellipse board-like motor vertical supporter material 55 vehicle up down one, floating mounting of the in wheel motor 3 can be carried out to a part for the spring lower part which are the axle part components of a vehicle, and a motor shaft and an axis arm become rockable only in the vertical direction independently. For this reason, motor mass is separated from an equivalent for the nonsuspended mass of a vehicle, and acts as the so-called weight of a tuned damper. Since the weight of a tuned damper negates the oscillation in the concavo-convex way transit above under a spring, fluctuation of the tire touch-down force can reduce it, and the road-holding nature of a vehicle not only improves, but it can make small the oscillating load to the motor 3 at the time of bad road transit.

Moreover, by combining a motor 3, the motor mounting member 52 and the motor vertical supporter material 55, and a knuckle 5 through the direct-acting guide 57 to which it shows an elastic body 56 and a vehicle cross direction Since it was made to support also to a vehicle cross direction to the above-mentioned knuckle 5, a motor shaft and an axis arm become rockable independently also at a vehicle cross direction, thereby, can also decrease tire order force fluctuation and can stabilize the tire engine performance.

Moreover, in this example, since revolution side case 3b of a motor 3 and a wheel 2 were combined by the flexible coupling 51, while being able to transmit the running torque from Rota 3R to a wheel 2 efficiently, even when a motor vibrates at the time of bad road transit and a motor shaft and an axis arm carry out eccentricity, a revolution can be transmitted smoothly.

[0077]

In addition, the constant-velocity joint [ like ] shown in drawing 14 of the above-mentioned best gestalt 2 and drawing 15 as a means to combine the above-mentioned revolution side case 3b and a wheel 2 may be used. Since the in wheel motor 3 is rocked to the upper and lower sides and order within a wheel 2 by shifting and arranging the center of rotation of the fastener by the side of a wheel, and the center of rotation of a motor side fastener at this time, even if it carries out eccentricity, a revolution can be transmitted smoothly.

Moreover, also in this example, in order that the hub section 4 may support vehicle mass, its load load to motor 3 body is small. Therefore, since air gap change between stator-Rota can be made small, case rigidity can be lowered and a motor 3 can be lightweight-ized.

In addition, in the above-mentioned example, also when inner rotor mold motor 3I is used as an in wheel motor 3 as shown in drawing 67 although the outer rotor mold motor was used, the same effectiveness can be acquired.

[0078]

The best gestalt 15

Although the above-mentioned best gestalt 14 explained the case where the in wheel motor 3 which is a direct drive motor was attached, as shown in drawing 68 and drawing 69 , it is possible similarly to attach the geared motor 40 which was shown in drawing 57 of the above-mentioned best gestalt 13 and drawing 58 and which included the electric motor 41 and the reduction gear (planet reducer) 42 in the motor case 43 at one.

What is necessary is just to attach anchoring of a geared motor 40 in the knuckle 5 which is a fixed

part through the knuckle mounting member 66 of hollow discoid through the direct-acting guide 65 which shows the motor mounting member 63 of hollow discoid to anchoring and this motor mounting member 63 at an elastic body 64 and a vehicle cross direction through the direct-acting guide 61 and elastic body 62 which show the motor case 43 which is the nonrotation section to vehicle up down one, as shown in drawing 70 . Moreover, the output shaft and wheel 2 of a reduction gear 42 are connected like the above-mentioned best gestalt 13 by the shaft 45 which has universal-joint 45j (refer to drawing 68 and drawing 69 ).

The rotational speed of Rota 41R is changed into the rate equivalent to the cycle of revolution round the sun of planetary-gear 42b which revolves the surroundings of sun gear 42a around the sun, is slowed down, and is transmitted to a wheel 2 through the above-mentioned shaft 45 connected with the output shaft of the planet reducer 42 from carrier 42c.

in addition, the elastic body 64 and the direct-acting guide 65 which combine between the direct-acting guide 61 and elastic body 62 which combine between the above-mentioned motor case 43 and the motor mounting members 63, and the above-mentioned motor mounting members 63 and the knuckle mounting members 66 in this example -- alternation -- and it has arranged to four symmetry at each circumferencial direction.

[0079]

By this, while supporting a geared motor 40 through a direct-acting guide and an elastic body to vehicle up down one Since the knuckle which are the vertical direction supporter article and axle part components was supported through the direct-acting guide and the elastic body to the vehicle cross direction A motor shaft and an axis arm not only become rockable in the direction of a path independently, but being able to carry out floating mounting of the above-mentioned geared motor 40 to a part for the spring lower part which are the axle part components of a vehicle, a motor shaft and an axis arm become rockable independently at a vehicle cross direction. Therefore, since tire order force fluctuation can also be decreased while being able to reduce fluctuation of the tire touch-down force and being able to raise the road-holding nature of a vehicle, the tire engine performance can be stabilized.

Moreover, since a geared motor 40 is connected with the hub section 4 by the shaft 45 which has universal-joint 45j passing through the core, even if a geared motor 40 rocks relatively to an axle part part, turning effort can be certainly transmitted to a wheel 2.

[Example 4]

[0080]

The result analyzed with the vehicle oscillating model at the time of concavo-convex way transit as shows the fluctuation level of the touch-down force in the in wheel motor system by the above-mentioned best gestalt 15 and the conventional system and order force fluctuation in the table of the following drawing 71 - drawing 74 , and drawing 75 is shown in the graph of drawing 76 and drawing 77 . In addition, in drawing 71 - drawing 74 , (a) drawing is the vertical direction oscillating model, and (b) drawing is a cross-direction oscillating model. Moreover, in drawing 76 and drawing 77 , an axis of abscissa shows an excitation frequency (Hz), and an axis of ordinate shows the fluctuation level (N) of the tire touch-down force, and the fluctuation level (N) of the tire order force, respectively.

The example 4-1 to 4-3 of a comparison is the electric vehicle (EV) of the usual suspension format, and since a motor is carried in a car-body side and motor mass is equivalent to sprung mass, it is expressed by the oscillating-under spring model of two degrees of freedom as shown in drawing 71 (a) and (b) as a vehicle oscillating model. In the oscillating model by which nonsuspended mass m1 was combined with the ground plane, the elastic body k1, and dash pot c1 of a tire, and the above-mentioned nonsuspended mass m1 and sprung mass m2 were combined with the detail with the elastic body k2 and the dash pot c2, it becomes the model with which the mass of an electric motor is added to the above-mentioned sprung mass m2.

Moreover, since a motor is attached in a wheel, a knuckle, etc. and motor mass is equivalent to nonsuspended mass, it is expressed by the vehicle (IWM) which adopted the conventional in wheel motor system shown in above-mentioned drawing 78 - drawing 80 by the oscillating-under spring model of two degrees of freedom by which the mass of an in wheel motor is added to the nonsuspended mass m1 as shown in drawing 72 (a) and (b) as a vehicle oscillating model (example

4-4 of a comparison). Thus, since nonsuspended mass increases when it equips with a motor directly to a nonsuspended mass equivalent part, as shown in drawing 76 , tire touch-down force fluctuation level increases, and road-holding nature gets worse. Moreover, as shown in drawing 77 , tire order force fluctuation level also increases and the tire engine performance becomes instability.
[0081]
Then, if spring Shimo weight is mitigated or suspension order rigidity is raised like the above-mentioned example 4-3 of a comparison to the example 4-1 of a comparison like the above-mentioned example 4-2 of a comparison, tire order force fluctuation level will be mitigated, but in this example 4-4 of a comparison, since the mass of an in wheel motor is added to nonsuspended mass m1, tire order force fluctuation level increases as a result.
Therefore, in order to maintain this on the level of the above-mentioned example 4-1 of a comparison with which the motor is not equipped, it is necessary to make AUW of a motor and axle part components the same. However, since the serious cost rise of using a light alloy etc. abundantly etc. is expected in order to lightweight-ize axle part components substantially, satisfying the reinforcement demanded, it cannot be said that it is practical.
[0082]
There is an approach called the tuned damper expressed with a model as shown in drawing 73 (a) and (b) as an approach of on the other hand reducing fluctuation of the tire touch-down force at the time of concavo-convex way transit, without carrying out especially lightweight-ization (example 4-5 of a comparison of the table of drawing 75 ). 3 degree-of-freedom model to which the new weight m3 was added through the elastic body k3 and the dash pot c3 can express this to the nonsuspended mass m1 of 2 degree-of-freedom model of above-mentioned drawing 72 (a) and (b), and as shown in drawing 76 and drawing 77 , it has the effectiveness of reducing both the fluctuation level of the tire touch-down force, and the fluctuation level of the tire order force.
By this approach, it was effective so that the additional weight m3 was increased, but since this additional weight m3 made vehicle weight only increase in addition to reduction of the above-mentioned fluctuation level, since it became an adverse effect, there was a limitation in the increment in the above-mentioned weight m3 for a vehicle.
[0083]
In the in wheel motor system of this invention On the other hand, drawing 65 , drawing 67 , Since it is considering as the configuration which attaches the in wheel motor 3 (3I, 40) in a car-body side through an elastic body and/or an attenuation device as shown in drawing 68 , or as a vehicle oscillating model As shown in drawing 74 (a) and (b), 3 degree-of-freedom model (example 4-1 of drawing 75 ) which combined motor mass with nonsuspended mass m1 through the elastic body k3 and the dash pot c3 can express. In above-mentioned drawing 74 (a) and (b), this removes the motor mass added to nonsuspended mass m1, and is taken as the additional weight m3 which uses this motor mass for a tuned damper. Therefore, it can be made the electric vehicle and equivalent level which have not adopted the usual in wheel motor system which showed touch-down force fluctuation level and order force fluctuation level to the above-mentioned example 4-1 of a comparison, without increasing car weight in an excess, as shown in the graph of drawing 76 and drawing 77 .
Moreover, since the weight of a tuned damper increases when a motor is made heavy to the above-mentioned example 4-1 (example 4-2 of drawing 75 ), the fluctuation level of the tire touch-down force and the fluctuation level of the tire order force can be reduced further.
Moreover, since the above-mentioned fluctuation level increases when the elastic modulus of an elastic body is enlarged (example 4-3), as for the elastic modulus of an elastic body, it is desirable to make it small.
[Availability on industry]
[0084]
Since according to this invention the fluctuation level of the touch-down force at the time of concavo-convex way transit of a vehicle can be reduced and the road-holding nature of a vehicle can be raised by making an in wheel motor act as weight of a tuned damper to nonsuspended mass as explained above, it becomes possible to excel in space efficiency or the transmission efficiency of driving force, and to realize the good in wheel motor vehicle of the road-holding nature of a vehicle.

[Brief Description of the Drawings]
[0085]
[Drawing 1] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the best gestalt 1 of this invention.
[Drawing 2] It is the transverse-plane sectional view showing the in wheel motor structure of a system concerning the gestalt 1 best [ this ].
[Drawing 3] It is drawing showing the splash condition of the in wheel motor concerning the gestalt 1 best [ this ].
[Drawing 4] It is drawing showing other configurations of the in wheel motor system concerning the gestalt 1 best [ this ].
[Drawing 5] It is drawing showing other configurations of the in wheel motor system concerning the gestalt 1 best [ this ].
[Drawing 6] It is drawing showing the in wheel motor structure of a system using the pneumatic spring concerning this invention.
[Drawing 7] It is drawing showing the in wheel motor structure of a system using a direct-acting guide device including the damper concerning this invention.
[Drawing 8] It is drawing showing the splash condition of the in wheel motor of drawing 7 .
[Drawing 9] It is drawing showing the in wheel motor structure of a system using the damper device which comes to join the rib concerning this invention together with an elastic body.
[Drawing 10] It is drawing showing the splash condition of the in wheel motor at the time of using a cylindrical elastic body.
[Drawing 11] It is drawing showing the configuration method of the tabular elastic body concerning this invention.
[Drawing 12] It is drawing showing the relation between the number of arrangement of a tabular elastic body, and vertical rigidity.
[Drawing 13] It is drawing showing the high Brit type in wheel motor structure of a system concerning this invention.
[Drawing 14] It is drawing showing the in wheel motor structure of a system using the constant-velocity joint concerning the gestalt 2 best [ this ].
[Drawing 15] It is drawing for explaining actuation of a constant-velocity joint.
[Drawing 16] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 3 best [ this ].
[Drawing 17] It is the important section sectional view showing the in wheel motor structure of a system concerning the gestalt 3 best [ this ].
[Drawing 18] It is drawing showing arrangement of a direct-acting guide.
[Drawing 19] It is drawing showing the example of a configuration of a direct-acting guide.
[Drawing 20] It is drawing showing other configurations of a flexible coupling.
[Drawing 21] It is the important section sectional view of drawing 20 .
[Drawing 22] It is drawing for explaining the actuation of a flexible coupling shown in drawing 20 and drawing 21 .
[Drawing 23] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the best gestalt 4 of this invention.
[Drawing 24] It is drawing showing the configuration of the flexible coupling concerning the gestalt 4 best [ this ].
[Drawing 25] It is drawing for explaining actuation of the flexible coupling concerning the gestalt 4 best [ this ].
[Drawing 26] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the best gestalt 5 of this invention.
[Drawing 27] It is drawing showing the configuration of the flexible coupling concerning the gestalt 5 best [ this ].
[Drawing 28] It is drawing for explaining actuation of the flexible coupling concerning the gestalt 5 best [ this ].
[Drawing 29] It is drawing showing other configurations of the flexible coupling by this invention.
[Drawing 30] It is drawing of longitudinal section showing the in wheel motor structure of a system

concerning the gestalt 6 best [ this ].

[Drawing 31] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 7 best [ this ].

[Drawing 32] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 8 best [ this ].

[Drawing 33] It is drawing showing the configuration of the shock absorber concerning the gestalt 8 best [ this ].

[Drawing 34] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 9 best [ this ].

[Drawing 35] It is drawing showing the configuration of the shock absorber equipped with the oil hydraulic cylinder concerning the gestalt 9 best [ this ].

[Drawing 36] It is drawing showing the detail of the shock absorber equipped with the oil hydraulic cylinder.

[Drawing 37] It is drawing showing other configurations of the shock absorber equipped with the oil hydraulic cylinder concerning the gestalt 9 best [ this ].

[Drawing 38] It is drawing showing other configurations of the shock absorber equipped with the oil hydraulic cylinder concerning the gestalt 9 best [ this ].

[Drawing 39] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 10 best [ this ].

[Drawing 40] It is the important section sectional view showing the in wheel motor structure of a system concerning the gestalt 10 best [ this ].

[Drawing 41] It is drawing showing the vehicle oscillating model in the conventional in wheel motor system.

[Drawing 42] It is drawing showing the vehicle oscillating model at the time of equipping with a tuned damper to the conventional in wheel motor system.

[Drawing 43] It is drawing showing the vehicle oscillating model in the in wheel motor system of this invention.

[Drawing 44] It is the table showing many constants set up with each vehicle oscillating model, such as mass and a load rate.

[Drawing 45] It is drawing showing the analysis result of a vehicle oscillating model.

[Drawing 46] It is drawing showing the relation between a tire touch-down load and a cornering power (CP).

[Drawing 47] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 11 best [ this ].

[Drawing 48] It is the important section sectional view showing other configurations of the in wheel motor system by this invention.

[Drawing 49] It is drawing of longitudinal section showing other configurations of this invention **** in wheel motor system.

[Drawing 50] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 12 best [ this ].

[Drawing 51] It is drawing of longitudinal section showing other configurations of the in wheel motor system by this invention.

[Drawing 52] It is drawing showing the vehicle oscillating model in the conventional in wheel motor system.

[Drawing 53] It is drawing showing the vehicle oscillating model in the in wheel motor system equivalent to drawing 50 of this invention.

[Drawing 54] It is drawing showing the vehicle oscillating model in the in wheel motor system equivalent to drawing 51 of this invention.

[Drawing 55] It is the table showing many constants set up with each vehicle oscillating model, such as mass and a load rate.

[Drawing 56] It is drawing showing the analysis result of a vehicle oscillating model.

[Drawing 57] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 13 best [ this ].

[Drawing 58] It is the important section sectional view showing the in wheel motor structure of a

system concerning the gestalt 13 best [ this ].

[Drawing 59] It is drawing showing the configuration and actuation of drawing 58 of the 44 sections concerning the gestalt 13 best [ this ].

[Drawing 60] It is drawing showing the vehicle oscillating model in the conventional in wheel motor system.

[Drawing 61] It is drawing showing the vehicle oscillating model at the time of equipping with a tuned damper to the conventional in wheel motor system.

[Drawing 62] It is drawing showing the vehicle oscillating model in the in wheel motor system of this invention.

[Drawing 63] It is the table showing many constants set up with each vehicle oscillating model, such as mass and a load rate.

[Drawing 64] It is drawing showing the analysis result of a vehicle oscillating model.

[Drawing 65] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 14 best [ this ].

[Drawing 66] It is drawing showing the means of attachment of the in wheel motor system concerning the gestalt 14 best [ this ].

[Drawing 67] It is drawing of longitudinal section showing other configurations of the in wheel motor system by this invention.

[Drawing 68] It is drawing of longitudinal section showing the in wheel motor structure of a system concerning the gestalt 15 best [ this ].

[Drawing 69] It is the important section sectional view of drawing 68 .

[Drawing 70] It is drawing showing the means of attachment of the in wheel motor system concerning the gestalt 15 best [ this ].

[Drawing 71] It is drawing showing the vehicle oscillating model in the conventional electric vehicle system.

[Drawing 72] It is drawing showing the vehicle oscillating model in the conventional in wheel motor system.

[Drawing 73] It is drawing showing the vehicle oscillating model which added the tuned damper to the conventional in wheel motor system.

[Drawing 74] It is drawing showing the vehicle oscillating model in the in wheel motor system of this invention.

[Drawing 75] It is the table showing many constants set up with each vehicle oscillating model, such as mass and a load rate.

[Drawing 76] It is drawing showing the analysis result of a vehicle oscillating model.

[Drawing 77] It is drawing showing the analysis result of a vehicle oscillating model.

[Drawing 78] It is drawing showing the conventional in wheel motor structure of a system.

[Drawing 79] It is drawing showing the conventional in wheel motor structure of a system.

[Drawing 80] It is drawing showing the conventional in wheel motor structure of a system.

[Description of Notations]

[0086]

1 Tire and 2 Wheel and 2a Rim and 2b Wheel Disc,

3 In Wheel Motor and 3R Rota, 3S Stator, and 3G Air Gap,

3a A nonrotation side case and 3b A revolution side case and 3j A bearing and 4 Hub section,

5 Knuckle, and 6a and 6B Suspension Arm and 7 Suspension Member,

8 Damping Device and 8a Brake Rotor and 8B Brake Caliper,

11 1st Elastic Member and 12 Connection Member and 12a Supporter Material and 12B Arm,

13 The 2nd elastic member.

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[Translation done.]

* NOTICES *
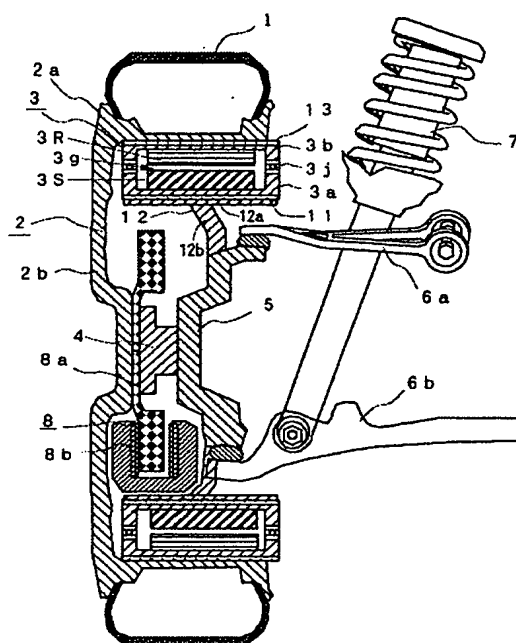
DRAWINGS

[Drawing 1]



[Drawing 2]



[Drawing 3]

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固定部
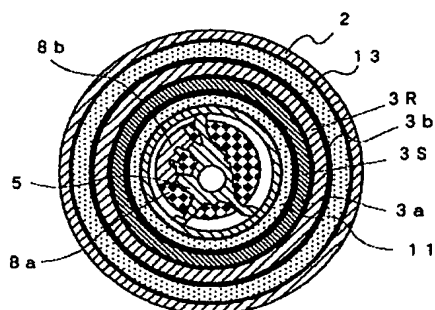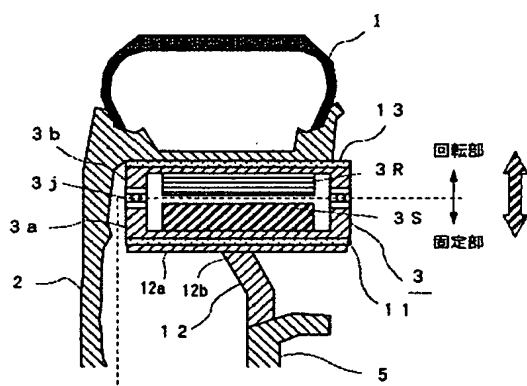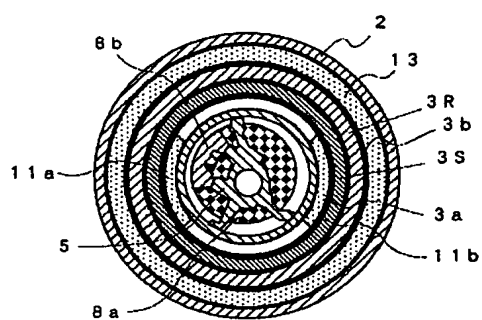
[Drawing 4]



[Drawing 5]
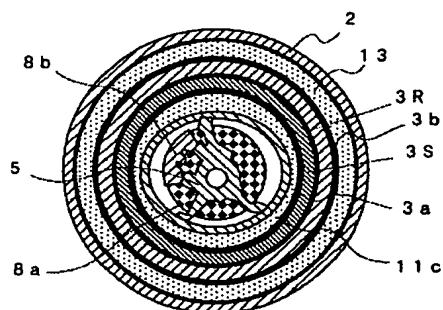


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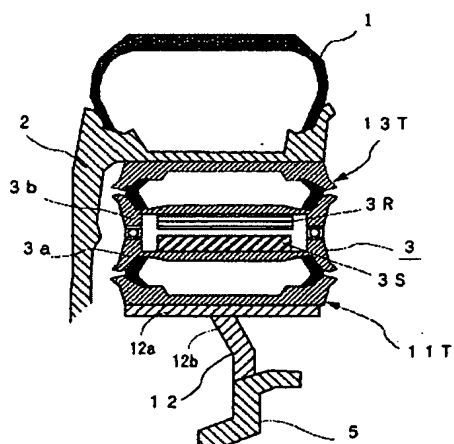
[Drawing 7]



[Drawing 8]



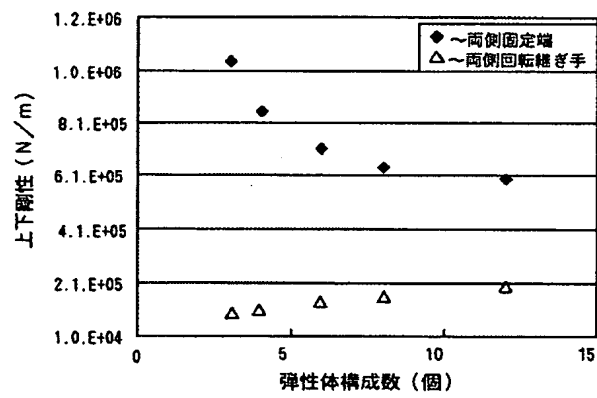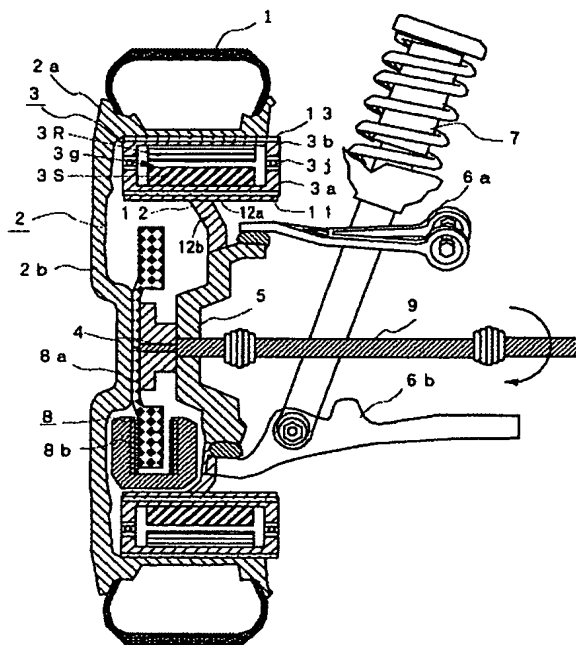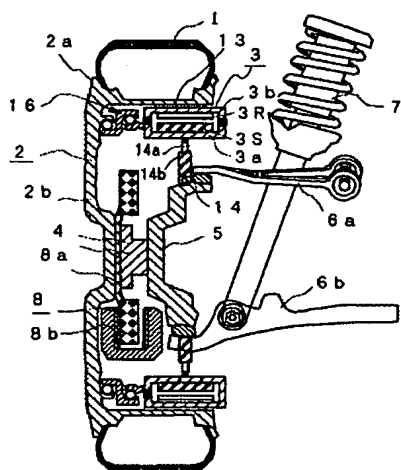回転部

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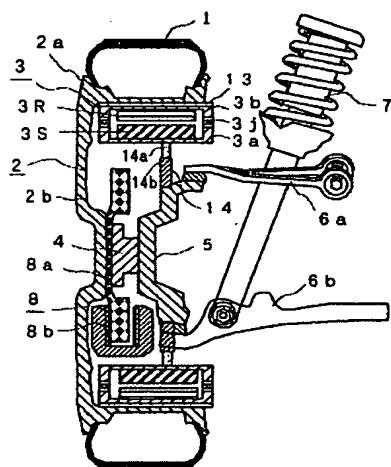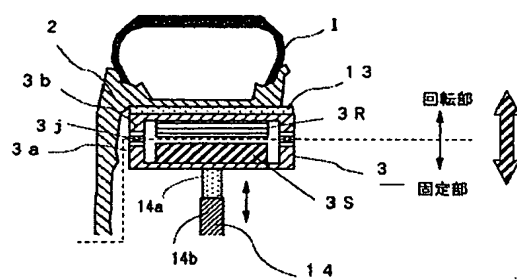
[Drawing 9]

[Drawing 10]
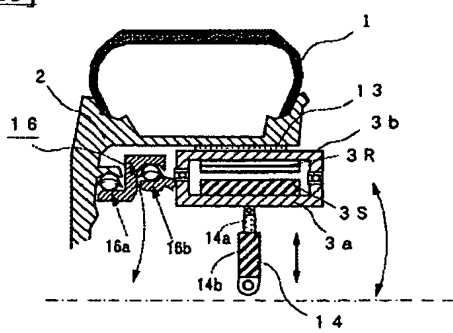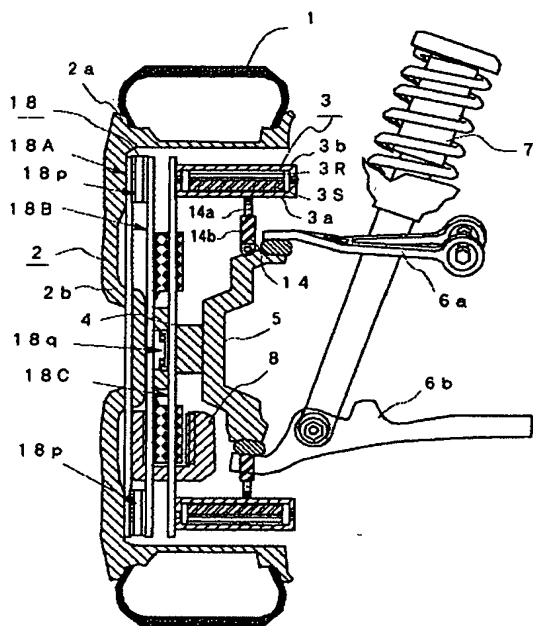
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[Drawing 11]
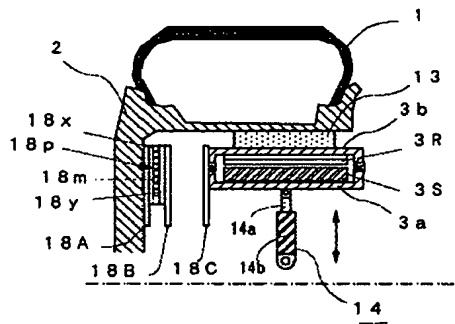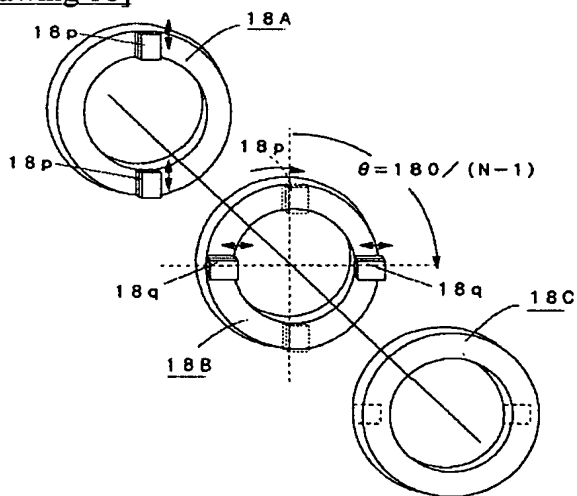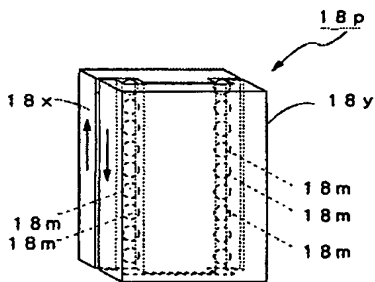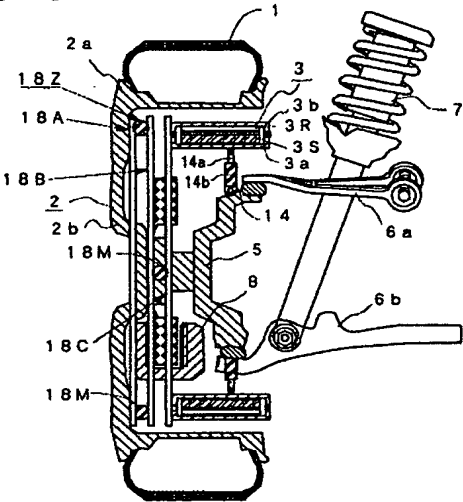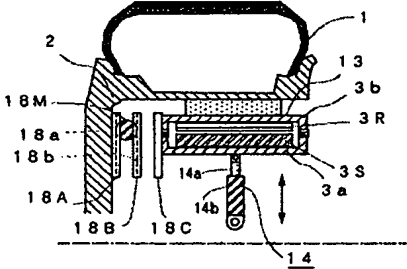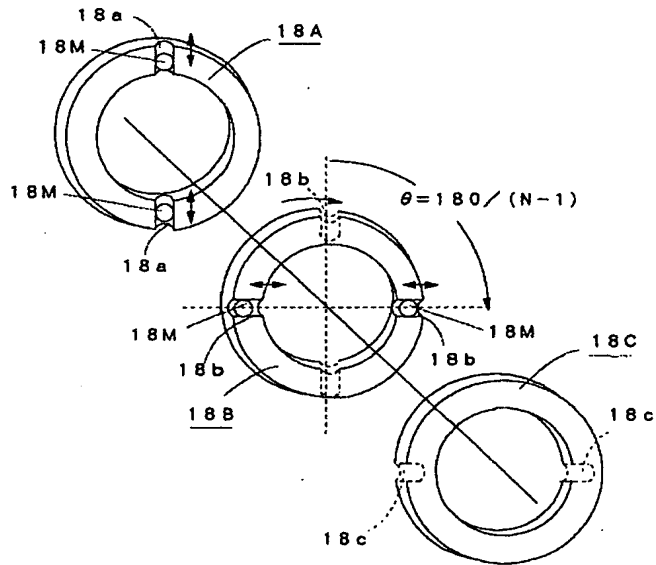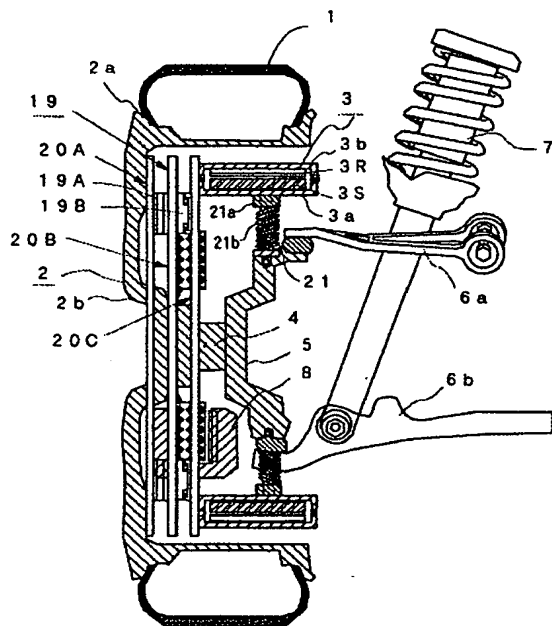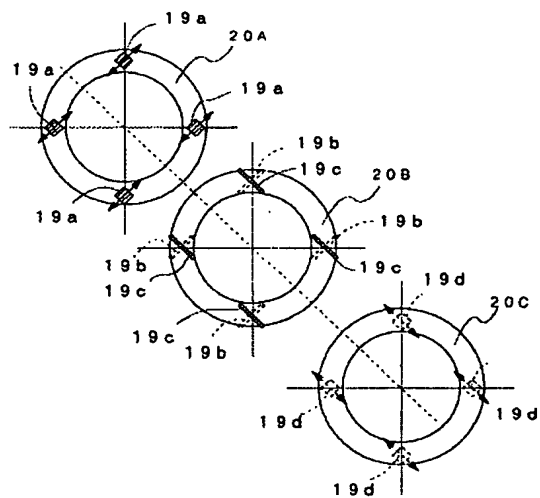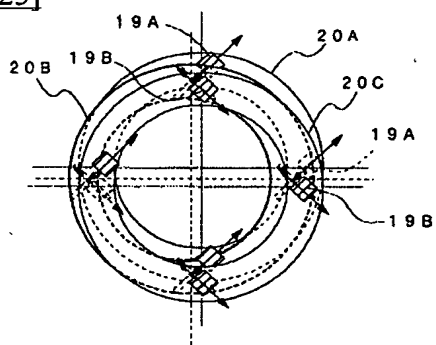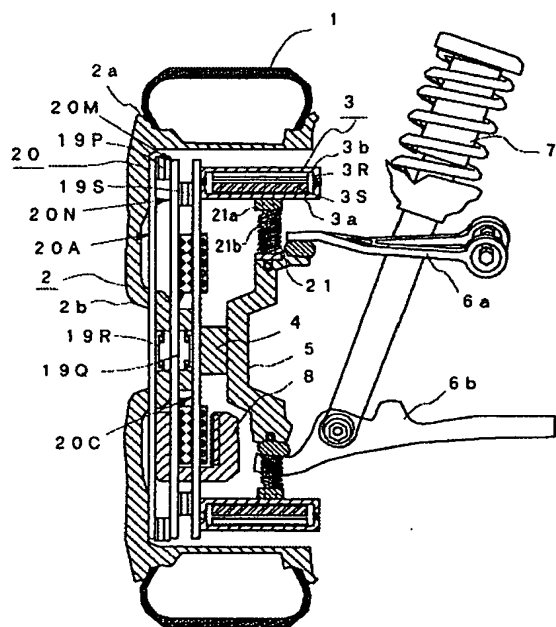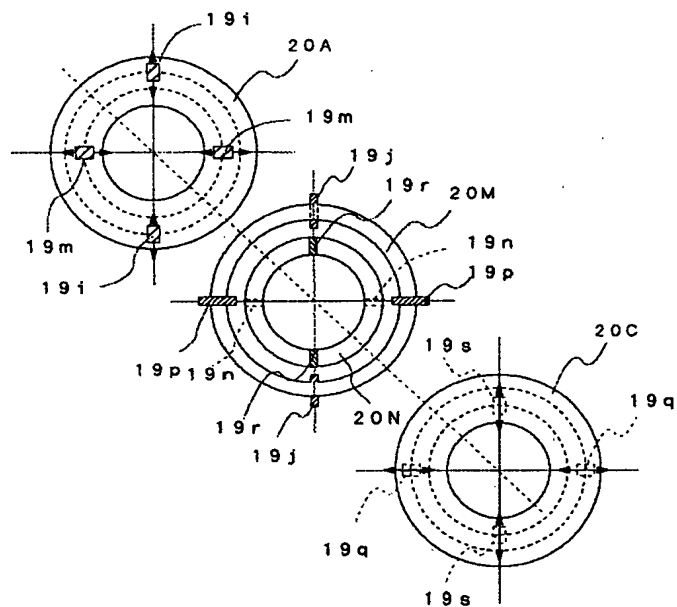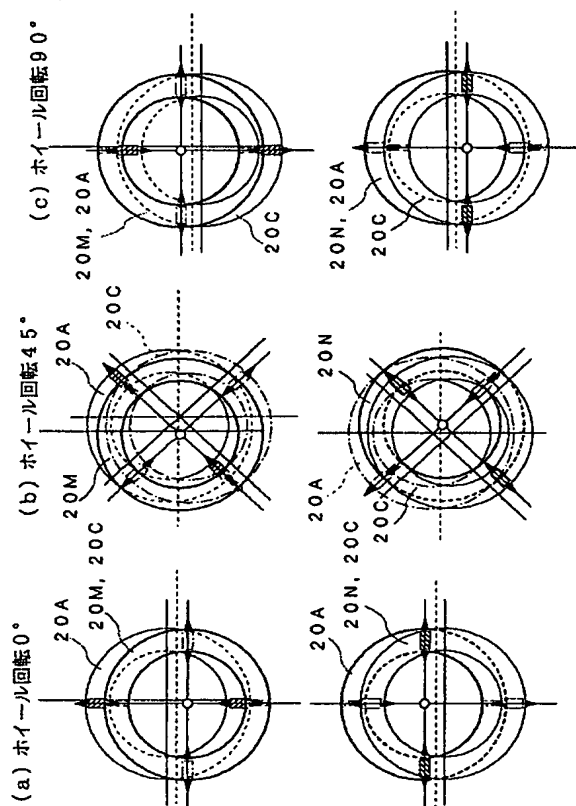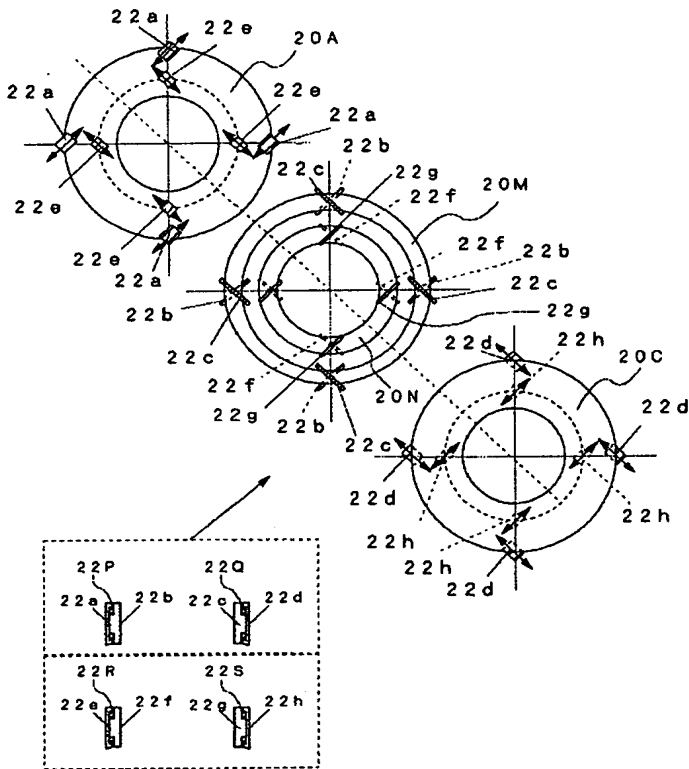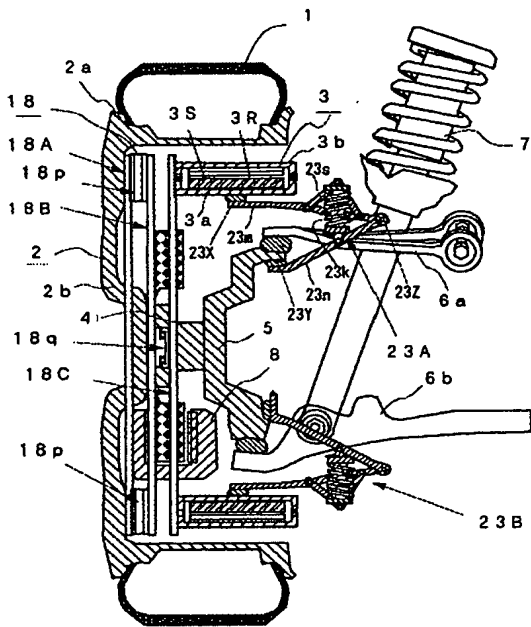
（a）

（b）
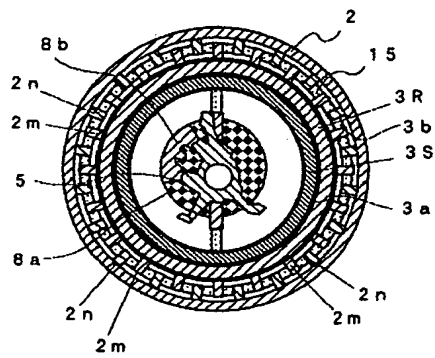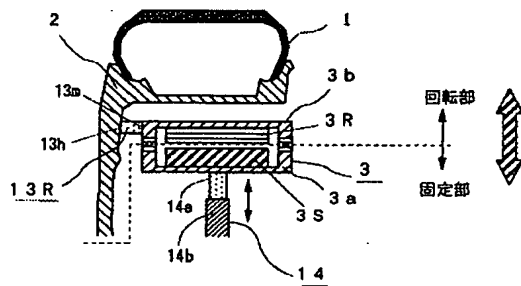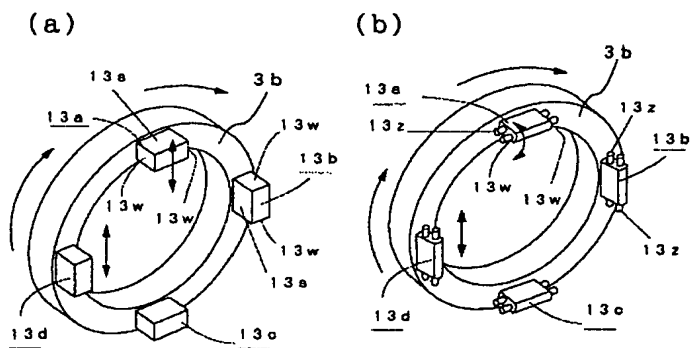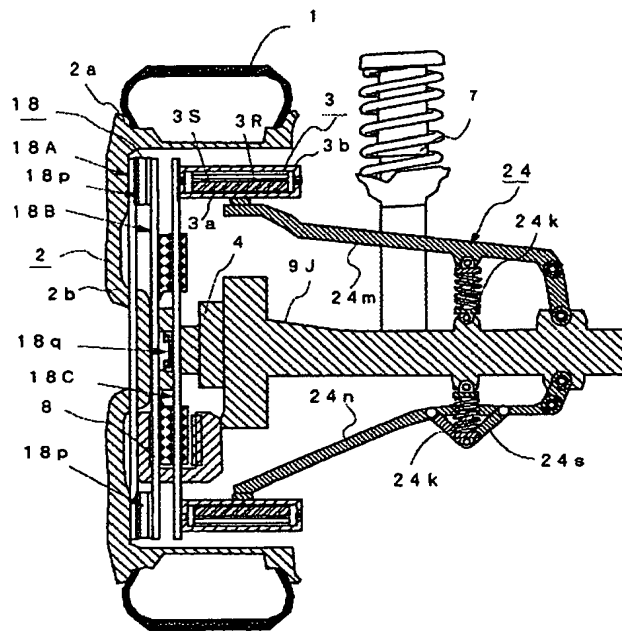
[Drawing 12]

[Drawing 13]



[Drawing 14]

[Drawing 15]

[Drawing 16]

[Drawing 17]



[Drawing 18]



$\theta = 180 / (N-1)$

[Drawing 19]

18p

18x 18y

18m
18m

18m 18m
18m 18m

[Drawing 20]

1
2a
18Z
18A
3
3b
3R
3S
3a
14a
14b
18B
2
2b
18M
5
8
6a
14
6b
18C
18M
7

[Drawing 21]

1
2
13
3b
18M
3R
18a
3S
18b
3a
14a
18A
14b
18B 18C
14

[Drawing 22]

18a
18M
18A
18M
18b
θ=180／（N−1）
18M
18M
18a
18M
18b
18b
18C
18b
18c
18B
18c

[Drawing 23]

1
2a
19
3
20A
3b
19A
3R
19B
3S
20B
3a
21a
2
21b
2b
21
20C
6a
4
5
8
6b

[Drawing 24]

[Drawing 25]

[Drawing 26]
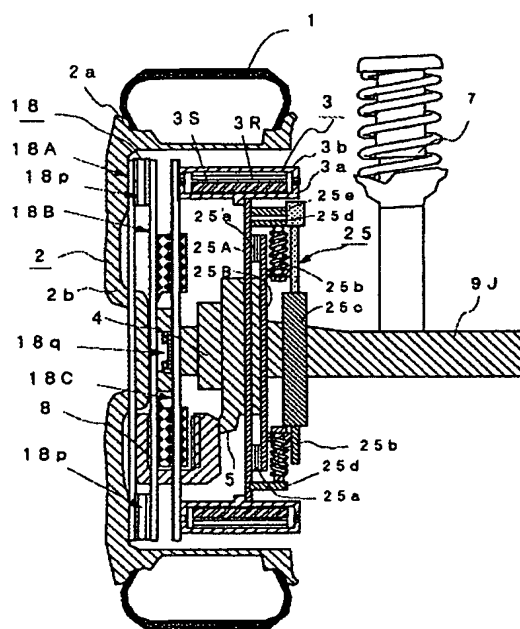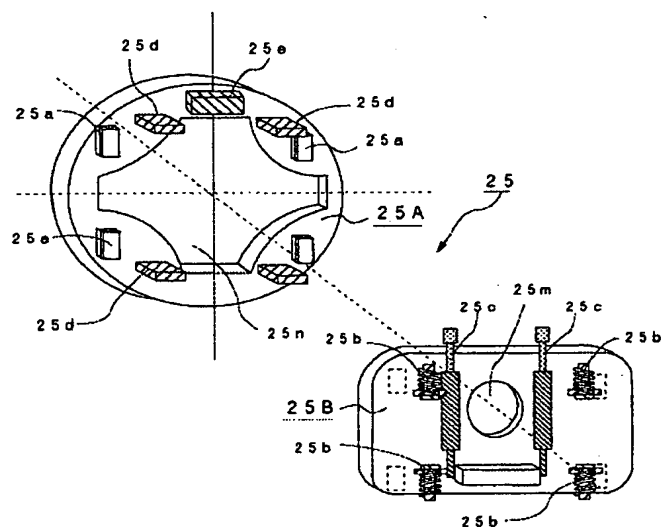
[Drawing 27]



[Drawing 28]

[Drawing 29]



[Drawing 30]

[Drawing 31]



[Drawing 32]

[Drawing 33]



[Drawing 34]